THE

MUSCULAR MOTIONS

OF THE

HUMAN BODY.

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of
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the Author

THE

MUSCULAR MOTIONS

OF THE

HUMAN BODY.

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OF EDINBURGH, &c. &c.

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TO

Dr THOMAS THOMSON,

LECTURER ON CHEMISTRY, AND FELLOW OF THE ROYAL SOCIETY OF EDINBURGH.

Dear Sir,

Though you be not so much interested in Anatomy as in that science which so widely extends your fame over Europe, and is likely to extend it to distant posterity; yet knowing the interest also which you take in whatever tends to illustrate the functions of the animal system, I dedicate to you the following Treatise on the Muscular Motions of the Human Body: happy in having this opportunity of acknowledging with what affection and esteem, I ever am,

Dear Sir,

Your sincere friend,

JOHN BARCLAY.

TO

MY PUPILS.

GENTLEMEN,

FROM the very few elementary substances that enter into the nourishment of plants, regarded as simple, because chemistry has not yet analysed them, are produced all the wonderful varieties of solids and fluids, of magnitudes and forms, of odours, of colours, and of organizations, that are to be found in the vegetable kingdom. By new combinations of the same substances, are likewise produced all the varieties of solids and fluids, of magnitudes and forms, of odours, of colours, and of organizations, that distinguish the different species of animals. These varied and endless combinations in the works of Nature, all of them obviously regulated by design, must imply degrees of wisdom and power, as much superior to those which are indicated in the works of art, as the unbounded know-

ledge of Deity surpasses the limited intelligence of man. The mode, however, in which many of these combinations are formed, must, from their minuteness, for ever elude the most penetrating eye; and from their intricacy, or from unknown causes concerned, for ever bid defiance to human research.

It is only in the muscular motions of animals, that the wonderful manner in which many of these combinations are formed, may be traced to causes that are visible, distinct, and within the reach of every observer; and this happy and illustrative instance of the method in which the Sovereign of the Universe produces an incalculable variety of effects, by the means of a few secondary agents, must render the motions of the animal system highly interesting to every studious philosophic mind.

By the varied and combined actions of the muscles, which every man sees, or easily may see, there is formed an exhaustless source of distinctions for every individual of the human species, not only in the expressions of the countenance, the articulation, the tone of voice, and the handwriting, but in the motions of walking and run-

ning, in the attitudes of standing, and the mode of placing the foot upon the ground. By the same species of combined action, are likewise produced all the singular varieties of language, that have ever distinguished, that now distinguish, or that ever will be found to distinguish nations; all the singular species of exercise; and all the varied operations of art. In tracing these phenomena to their source, the philosopher and divine might find almost innumerable proofs of the power, the wisdom, and the providence of Deity; and might thence inculcate, with more than ordinary clearness and force, some of the most useful and important truths that ever were impressed on the human mind.

It was not, however, with such views that I undertook the following Treatise on the Muscular Motions of the Human Body. Through the whole, my attention has been chiefly directed to extend your knowledge of the animal functions; and through that medium, so far as the muscular functions are concerned, to improve the science of physic and surgery.

Though Winslow and others have occasionally shown how a knowledge of the muscles may

often be useful in ascertaining the nature of symptoms, and in leading to the proper methods of cure, the subject is far from having attracted that degree of attention to which it is entitled. In works on anatomy, the muscles in general are arranged only according to regions; and arranged in that way chiefly with a view to be subservient to the purposes of dissection. That such arrangements are useful and necessary, every person of candour will admit: But in describing the muscles of a region, where those belonging to different motions are classed together, if the teacher of anatomy, from indolence, neglect, or any other cause, shall content himself with merely assigning to each muscle its separate use, or with sometimes mentioning the compound action of it and its fellow, the student can derive but little advantage from such information; there being no motion in the body that at once is performed, moderated, and directed by a single muscle, or a pair of muscles. He even may see every muscle in its turn, may hear a minute and accurate description of its form, its situation, its use, and its attachments; and yet be as ignorant, or nearly as ignorant, of the motions of the body, as when he first entered

on his studies. What is even worse, he may be naturally led to infer, that myology itself is of no use in the practice either of surgery or physic, except when occasionally the knowledge of a muscle may happen to assist him in discovering the situation of an artery or nerve.

To obviate conclusions so absurdly erroneous, so flattering to indolence, ignorance, and presumption, but so very inimical to the zeal and ardour of professional improvement, besides exhibiting arrangements of the muscles according to regions, and arranging those peculiarly belonging to the osseous structure according to the bones to which they are attached, I have arranged the whole of the muscles belonging to the system according to the motions in which they co-operate. From the first of these species of arrangements, you will see what muscles are likely to be supplied with the same branches of arteries and nerves; from the second, what parts of the osseous structure are connected by muscles; and from the third, what muscles co-operate, and how they co-operate, in performing their motions. From the whole, you will learn the nature and causes of a number of sympathies that arise from attachment, situation, and func-

tion; be able to explain many singular symptoms that occur in disease; and often be able to provide a safe, expeditious remedy, where others, that are less acquainted with myology, would be torturing their patients with all the contrivances of ignorant empiricism *.

In cases, particularly, of luxation and fracture, you will readily perceive what are the motions that are best calculated to favour the reduction; what are the muscles that are fitted to assist, and what to oppose you in the operation; what are the positions that are best suited to preserve the ease and security of the parts; and what the motions, attitudes, and muscles most likely to disturb them. Hitherto the surgeon, in these operations, has seldom called in, and could seldom call in, the aid of myology; and hence, his success depending so much on force, accident, or manual dexterity, he has sometimes been equalled, and, with the vulgar at least, been often surpassed, in point of reputation, by the ignorant bone-setter. To remove, Gentlemen, even the chance of such a comparison, let me earnestly ad-

* See p. 325.

vise you to study the compound actions of the muscles; the only way in which you can ever possibly understand the admirable mechanism of the human body. By thus adding science to art, though you cannot always expect to be successful, yet, by a patient and steady perseverance, you may reasonably hope to bring the treatment of luxation and fracture to a much higher degree of perfection than it has been hitherto.

Through the whole of this Work, I have invariably adhered to the terms of position and aspect which I formerly recommended in my Nomenclature; these terms being more precise than the vague terms that are usually employed, and which change their meaning with every slight change of position.

If the Work has been delayed beyond the promised time of publication, it was not from either indolence or neglect to fulfil my engagement. I did not foresee the many interruptions and the many difficulties which I had to encounter. It is now, however, brought to a close; and such as it is, I present it to you, containing some errors which I have corrected, and many perhaps which I have not seen. If it be so fortunate as to add to your

knowledge of the Animal Structure, or improve your practice in Physic and Surgery, I shall think my labour amply rewarded. And with much interest in the progress of your studies, success in your profession, and prosperity in life, I remain,

GENTLEMEN,

Your much obliged,

And sincere well-wisher,

JOHN BARCLAY.

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Containing arrangements of the muscles into regions, with the names of Albinus alphabetically arranged, and under each name the different synonyms.

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the different parts constituting a muscle, and general observations on muscular action.

PART III.

Containing different arrangements of the muscles, according to the motions in which they co-operate, and occasional explanations also of the manner in which they co-operate.

A Short EXPLANATION *of the several Terms of* POSITION *and* ASPECT*.

Aspects of the Head, Neck, and Trunk.

AN imaginary plane, dividing the head, neck, and trunk into similar halves, towards right and left, is the *mesial plane*. Every aspect towards this plane is *mesial*, and every aspect towards right or left, *lateral*; every lateral aspect being *dextral* or *sinistral*.

Aspects of the Head.

An aspect towards the plane of the *iner*, or ridge of the occiput, is *inial*; towards the plane of the corona, *coronal*; towards the base, *basilar*; towards the glabella, *glabellar*; or towards the side opposite to the *inion*, *antinial*.

* For a fuller account of the nature and extent of their application, and of the principles on which they are adopted, see the treatise on a New Anatomical Nomenclature.

Aspects of the Neck and Trunk.

An aspect towards the region where the atlas is situated is *atlantal* ; towards the region where the sacrum is situated, *sacral* ; towards the dorsum, *dorsal* ; and towards the plane of the sternum, *sternal.*

Aspects of the Four Extremities.

An aspect of a bone towards the trunk, in the course of the extremity, is *proximal* ; and if from the trunk in the course of the extremity, *distal.*

Aspects of the Atlantal Extremities.

An aspect towards the side on which the radius is situated is *radial* ; if towards the side on which the ulna is situated, *ulnar* ; if towards the side on which the ancon is situated, *anconal* ; and if towards the side on which the vola or θεναρ is situated, *thenal.*

Aspects of the Sacral Extremities.

An aspect towards the side on which the tibia is situated is *tibial* ; if towards the side on which the fibula is situated, *fibular* ; if towards the side on which the rotula is situated, *rotular* ; and if towards the side on which the poples is situated, *popliteal.*

Terms of Aspect common to the Head, Neck, Trunk, Extremities, and Viscera.

An aspect towards the cutis, *dermal*; if towards the circumference of any part, *peripheral*; and if towards its centre, *central*.

When *d* is substituted for the *l* or *r* that terminate these adjectives, they become adverbs, or are used adverbially; so that *coronad*, *iniad*, *glabellad*, *radiad*, *ulnad*, *tibiad*, *fibulad*, &c. will respectively signify towards the coronal, inial, glabellar, radial, ulnar, tibial, and fibular aspects.

PART I.

CONTAINING

ARRANGEMENTS OF THE MUSCLES INTO REGIONS, WITH THE NAMES OF ALBINUS ALPHABETICALLY ARRANGED, AND UNDER EACH NAME THE DIFFERENT SYNONYMS.

OF THE

MUSCULAR MOTIONS

OF THE

HUMAN BODY.

REGIONS *into which the Muscles are arranged according to* ALBINUS.

I. *CALVA.*

Epicranius

II. *Circa Auriculam.*

Attollens auriculæ
Anterior auriculæ
Retrahentes tres, superior, medius, inferior

III. *Facies.*

Orbicularis palpebrarum
Corrugator supercilii

Compressor narium
Levator labii superioris alæque nasi
Levator labii superioris
Zygomaticus minor
Levator anguli oris
Zygomaticus major
Depressor anguli oris
Depressor labii inferioris
Nasalis labii superioris
Buccinator
Orbicularis oris
Depressor alæ nasi
Levator menti

IV. *Mala et Latus Calvæ.*

Masseter
Temporalis

V. *Cavum Oculi.*

Levator palpebræ superioris
Obliquus superior oculi
Rectus attollens
Rectus abductor
Rectus adductor
Rectus depressor
Obliquus inferior

VI. *Auricula.*

Tragicus
Antitragicus

Major helicis
Minor helicis
Transversus auriculæ

VII. *Auris Interna.*

Externus mallei
Laxator tympani
Tensor tympani
Stapedius

VIII. *Collum.*

Latissimus colli
Sterno-mastoideus
Cleido-mastoideus
Coraco-hyoideus
Sterno-hyoideus
Sterno-thyreoideus
Hyo-thyreoideus
Biventer maxillæ
Stylo-hyoideus
Stylo-hyoideus alter
Stylo-glossus
Stylo-pharyngeus
Mylo-hyoideus
Genio-hyoideus
Cerato-glossus
Basio-glossus
Chondro-glossus
Genio-glossus

Lingualis
Constrictor pharyngis inferior
Constrictor pharyngis medius
Constrictor pharyngis superior
Salpingo-pharyngeus
Palato-pharyngeus
Constrictor isthmi faucium
Levator palati mollis
Circumflexus palati
Azygus uvulæ
Crico-thyreoideus
Crico-arytænoideus posticus
Arytænoideus obliquus
Arytænoideus transversus
Crico-arytænoideus lateralis
Thyreo-arytænoideus
Thyreo-arytænoideus alter, minor

IX. *Sub Mala.*

Pterygoideus internus
Pterygoideus externus

X. *Pectus.*

Pectoralis
Serratus anticus
Subclavius

XI. *Latus Thoracis.*

Serratus magnus

XII. *Abdomen.*

Obliquus externus
Obliquus internus
Transversus
Rectus
Pyramidalis

XIII. *Circa Funem Spermaticum ac Testem.*

Cremaster

XIV. *Inter Abdomen Thoracemque.*

Diaphragma

XV. *Sub Pectore.*

Triangularis sterni

XVI. *Lumbi et Coxæ pars prior.*

Psoas parvus
Psoas magnus
Quadratus lumborum
Iliacus internus

XVII. *Circa Perinæum Viri.*

Accelerator
Erector penis

Genitalis muliebris Ambitus.

Constrictor cunni
Erector clitoridis

XVIII. *Circum Anum,*

Sphincter ani externus
Transversus perinæi
Transversus alter perinæi
Levator ani
Coccygeus
Curvator coccygis
Sphincter ani internus
In viro, compressores prostatæ

XIX. *Dorsum cum Lumborum posteriore parte et Cervice.*

Cucullaris
Latissimus dorsi
Rhomboideus major
Rhomboideus minor
Serratus posticus superior
Serratus posticus inferior
Levator scapulæ
Splenius capitis
Splenius colli
Biventer cervicis
Complexus
Trachelo-mastoideus
Transversalis cervicis
Cervicalis descendens
Sacro-lumbalis
Longissimus dorsi
Spinalis dorsi
Semispinalis dorsi

Spinalis cervicis
Interspinales cervicis
Rectus posticus major capitis
Rectus posticus minor capitis
Obliquus inferior capitis
Obliquus superior capitis
Multifidus spinæ
Interspinales lumborum
Interspinales dorsi
Intertransversarii lumborum
Intertransversarii dorsi
Levatores costarum breviores
Levatores costarum longiores

XX. *Spatia Intercostalia.*

Intercostales externi
Intercostales interni

XXI. *Colli Sceleti latus parsque prior.*

Scalenus prior
Scalenus minimus
Scalenus lateralis
Scalenus medius
Scalenus posticus
Rectus internus major capitis
Longus colli
Rectus internus minor capitis
Rectus lateralis capitis
Intertransversarii colli priores
Intertransversarii colli posteriores

XXII. *Scapula et Humeri pars superior.*

Deltoides
Supra-spinatus
Infra-spinatus
Teres minor
Teres major
Subscapularis

XXIII. *Humerus.*

Biceps brachii
Coraco-brachialis
Brachialis internus
Triceps brachii { Longus / Brevis / Brachialis externus }

XXIV. *Cubitus.*

Supinator longus
Radialis externus longior
Radialis externus brevior
Extensor communis digitorum manus
Extensor proprius digiti minimi manus
Ulnaris externus
Anconeus
Supinator brevis
Abductor longus pollicis manus
Extensor minor pollicis manus
Extensor major pollicis manus
Indicator
Ulnaris internus

Palmaris longus
Radialis internus
Pronator teres
Sublimis
Profundus
Flexor longus pollicis manus
Pronator quadratus

XXV. *Manus.*

Lumbricales
Abductor brevis pollicis manus
Opponens pollicis
Flexor brevis pollicis
Adductor pollicis
Palmaris brevis
Abductor digiti minimi
Flexor parvus digiti minimi
Adductor metacarpi digiti minimi
Interossei manus interni, viz.
Prior et posterior indicis
Prior annularis
Prior auricularis
Interossei manus externi, viz.
Prior et posterior medii
Posterior annularis
Abductor indicis

XXVI. *Nates.*

Gluteus magnus
Gluteus medius

Gluteus minor
Pyriformis
Gemini, superior et inferior
Obturator internus
Quadratus femoris

XXVII. *Femur.*

Biceps cruris
Semitendinosus
Semimembranosus
Tensor vaginæ femoris
Rectus cruris
Sartorius
Vastus externus
Vastus internus
Cruralis
Pectineus
Adductor longus femoris
Gracilis
Adductor brevis femoris
Obturator externus
Adductor magnus femoris

XXVIII. *Crus.*

Gemellus
Plantaris
Soleus
Popliteus
Flexor longus digitorum pedis
Flexor longus pollicis pedis

Tibialis posticus
Peroneus longus
Peroneus brevis
Extensor longus digitorum pedis
Peroneus tertius
Tibialis anticus
Extensor proprius pollicis pedis

XXIX. *Pedis extremi Digitorumque ejus Dorsum.*

Extensor brevis digitorum pedis

XXX. *Planta et Digitorum pedis pars inferior.*

Flexor brevis digitorum pedis
Abductor pollicis
Abductor digiti minimi
Lumbricales
Flexor brevis pollicis
Adductor pollicis
Transversus pedis
Flexor brevis digiti minimi
Interossei interni, viz.
 Primus digiti tertii
 Primus digiti quarti
 Primus digiti quinti
Interossei externi, viz.
 Primus et secundus digiti secundi
 Secundus tertii
 Secundus quarti

Musculorum omnium numerus, ut ait Albinus, haud facile iniri potest, quoniam non idem omnibus hominibus. Quare sibi per se quisque, cui volupe, summam, ut faciundum patabit, colligat.

In hunc vero numerum retulimus non modo eos qui in omni homine reperiuntur, sed etiam eos qui quibusdam, eosque qui multis desunt; ut

Arytænideos obliquos
Chondro-glossos
Curvatores coccygis
Flexores parvos digitorum auricularium
Psoas parvos
Retrahentes inferiores auricularum
Scalenos laterales
Scalenos minimos
Stylo-hyoideos alteros
Zygomaticos minores
Transversos perinæi

eosque qui quandoque cum aliis prorsus conjuncti; ut

Biventres cervicis
Peroneos tertios
Scalenos laterales
Splenios colli

Omisimus rariora naturæ ludentis exempla. Si quis autem miretur quid causæ sit, cur neque Cor, neque Sphincterem vesicæ, similesque partes, aut carneas aut ex fibris compositas, inter eos aliorum ad exemplum numeravimus; is sciat, cor a nobis, ob singularem et a musculis tantopere discrepantem

figuram, et conformationem, non musculum, sed partem musculosam dici: sphincterem vero vesicæ, aliosque ejus generis e fibris constantes contextus, quia partim in musculos proprie collecti non sunt, partim ex fibris albicantibus, non autem carneis constant; in musculorum numero non videri reponendos, nisi et musculosum stomachi et vesicæ urinariæ, et e fibris contextum ventriculi et intestinorum involucrum aliasque plurimas fibras, quæ multis partibus intextæ sunt, musculos appellare: eoque verorum musculorum historiam turbare velimus. At quosdam tamen, qui aut veri musculi sunt, aut certe ipsis quam simillimi retinendos existimavimus: ut

Attollentes auricularum
Tragicos
Antitragicos

aliosque similes.

Regions II. IV. V. VI. VII. IX. XI. XIII. XX. XXII. XXIII. XXIV. XXV. XXVI. XXVII. XXVIII. XXIX. XXX. are lateral regions, and consequently double. If reckoned separately, the number of regions will amount to forty-eight. But of these forty-eight, three are peculiar to the male; namely, the XVII. *circa perineum viri*, and the XIII. *circa funem spermaticum et testem*, considered as two. To the remaining regions, which are common to both sexes, the female adds one. See region XVII. So that the male, according to Albi-

nus, has forty-eight regions, the female forty-six; while the regions common to both are forty-five.

The double regions, with the exception of the XIII. belong to the extremities and the lateral aspects of the head and trunk; the single regions to the glabellar and inial aspects of the head, and to the sternal and dorsal of the trunk: these last extending, however, dextrad and sinistrad of the mesial plane, and containing muscles of the same kind on each side, there is in general, through the whole Table, but one half of the muscles enumerated in either the double or the single regions. The exceptions of Albinus are the

Epicranius
Azygus uvulæ
Diaphragma
Constrictor cunni
Sphincteres ani
Orbicularis oris
Arytænoideus transversus

Yet the dextral and sinistral parts of the Epicranius have very often a separate action, and may fairly be considered as different muscles, although united at the mesial plane without any marked line of distinction.

In some instances a line may be traced between the dextral and sinistral halves of the Azygus uvulæ and this line, exactly in the course of the mesial plane, which also divides into similar parts, dextrad and sinistrad, the Diaphragma, Con-

strictor cunni, Sphincteres ani, and Orbicularis oris. For though some anatomists have divided the last into two semiorbicular muscles, assigning one to the coronal and the other to the basilar lip; yet nature has chosen to divide it otherwise, placing the halves on the two sides, and forming their union at the mesial line, as is evident from hemiplegia and hair-lip.

The only pair that is not divided by the mesial plane, or between whose halves the mesial plane is not interposed, is the two Arytænoidei obliqui; and the only muscle which crosses that plane, and is not naturally distinguished into halves, is the Arytænoideus transversus.

But among the muscles which are reckoned in pairs, there are several groups on one side which have corresponding groups on the other, and where each group is considered as forming but one muscle. Among these groups are the

Constrictores pharyngis superiores
Constrictores pharyngis medii
Constrictores pharyngis inferiores
Interspinales cervicis
Interspinales dorsi
Interspinales lumborum
Intertransversarii priores colli
Intertransversarii posteriores colli
Intertransversarii dorsi
Intertransversarii lumborum

Levatores costarum breviores
Levatores costarum longiores
Intercostales externi
Intercostales interni
Lumbricales manuum
Lumbricales pedum

and a great many more.

Even various muscles, that in their appearance have not the most distant analogy to groups, are composed of parts that have different attachments, and that act as separate independent muscles. The common flexors of the toes and fingers are muscles of this kind. The fibres of these have similar origins but different insertions: the fibres of others, as the Pectoralis, have different origins but a similar insertion: while a third kind, as the Trapezius, have different origins and different insertions.

The groups and muscles of one side, that have groups and muscles corresponding on the other, are, according to Albinus, about two hundred and thirty-two; not including the Arytænoidei obliqui, nor the halves of muscles that are divided by the mesial line.

Yet, besides excluding from this enumeration the muscles of the heart, the stomach, intestines, and urinary bladder, he has also excluded some of the muscles that are pictured in his tables, as the

ciliaris * and the *thyreo-epiglotticus major* and *minor* †; avoiding, though not always, those trifling distinctions that distract the attention, and unnecessarily multiply the number of muscles.

The making of more trifling distinctions, the notice of several lusus naturæ, and collections of facts equally unimportant, which he has despised, remain to be the objects of modern discovery, and may, if we choose, be made a pretence for accusing him of neglect or inaccuracy; be made the means of impressing the public with a favourable idea of our own patience, acuteness, and diligence; and the means, at the same time, of establishing for ourselves a temporary reputation with the hunters of novelties that swarm among the thoughtless, illiterate, and vulgar.

* Albin. Tab. Muscul. XI. fig. 2. *a*, *b*, *c*, *d*, *e*.

† Albin. Tab. Muscul. XII. fig. 3. *f*, *g*, *h*; fig. 7. *a*, *b*, *c*; et fig. 3. *i*, *k*, *l*.

Regions *into which the Muscles are arranged according to* Innes.

I. *Muscles of the Teguments of the Cranium.*

Occipito-frontális
Corrugator supercilii

II. *Muscles of the Ear.*

1. Common
   Attollens aurem
   Anterior auris
   Retrahentes auris
2. Proper
   Helicis major
   Helicis minor
   Tragicus
   Antitragicus
   Transversus auris
3. Internal
   Laxator tympani
   Tensor tympani
   Stapedius

III. *Muscles of the Eyelids.*

Orbicularis palpebrarum
Levator palpebræ superioris

IV. *Muscles of the Eyeball.*

1. Straight
    - Levator oculi
    - Depressor oculi
    - Adductor oculi
    - Abductor oculi
2. Oblique
    - Obliquus superior, seu Trochlearis
    - Obliquus inferior

V. *Muscle of the Nose.*

Compressor naris

VI. *Muscles of the Mouth and Lips.*

1. Above
    - Levator anguli oris
    - Levator labii superioris alæque nasi
    - Depressor labii superioris alæque nasi
2. Below
    - Depressor anguli oris
    - Depressor labii inferioris
    - Levator labii inferioris
3. Outward
    - Buccinator
    - Zygomaticus major
    - Zygomaticus minor
4. Common
    - Orbicularis oris

VII. *Muscles of the Lower Jaw.*

Temporalis
Masseter
Pterygoideus internus
Pterygoideus externus

VIII. *Muscles which appear about the anterior part of the Neck*

Musculus cutaneus, vulgo Platysma myoides
Sterno-cleido mastoideus

IX. *Muscles situated between the Lower Jaw and Os Hyoides.*

1. Before
   Digastricus
   Mylo-hyoideus
   Genio-hyoideus
   Genio-hyo-glossus
2. At the side
   Hyo-glossus
   Lingualis

X. *Muscles situated between the Os Hyoides and Trunk.*

First Layer
Sterno-hyoideus
Omo-hyoideus

SECOND LAYER

Sterno-thyroideus
Thyreo-hyoideus
Crico-thyroideus

XI. *Muscles situated between the Lower Jaw and Os Hyoides laterally.*

Stylo-glossus
Stylo-hyoideus
Stylo-pharyngeus
Circumflexus, seu Tensor palati
Levator palati

XII. *Muscles situated about the entry to the Fauces.*

1. On the side
   Constrictor isthmi faucium
   Palato-pharyngeus
2. In the middle
   Azygos uvulæ

XIII. *Muscles situated on the posterior part of the Pharynx.*

Constrictor pharyngis inferior
Constrictor pharyngis medius
Constrictor pharyngis superior

XIV. *Muscles situated about the Glottis.*

Crico-arytænoideus posticus
Crico-arytænoideus lateralis
Thyreo-arytænoideus

Arytænoideus obliquus
Arytænoideus transversus
Thyreo-epiglottideus
Arytæno-epiglottideus

XV. *Muscles situated on the anterior part of the Abdomen.*

Obliquus descendens externus
Obliquus ascendens internus
Transversalis
Rectus abdominis
Pyramidalis

XVI. *Muscles about the Male Organs of Generation.*

1. Testes
   Dartos
   Cremaster
2. Penis
   Erector penis
   Accelerator urinæ, seu Ejaculator seminis
   Transversus perinæi
   Transversus perinæi alter

XVII. *Muscles of the Anus.*

Sphincter ani
Levator ani

XVIII. *Muscles of the Female Organs of Generation.*

Erector Clitoridis
Sphincter Vaginæ

XIX. *Muscles situated within the Pelvis.*

Obturator internus
Coccygeus

XX. *Muscles situated within the Cavity of the Abdomen.*

Diaphragma
Quadratus lumborum
Psoas parvus
Psoas magnus*
Iliacus internus*

XXI. *Muscles situated on the anterior part of the Thorax.*

FIRST LAYER
Pectoralis major
SECOND LAYER
Subclavius
Pectoralis minor
Serratus magnus

XXII. *Muscles situated between the Ribs and within the Thorax.*

Intercostales externi
Intercostales interni
Triangularis, seu Sterno-costalis

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* See Reg. XXIX.

XXIII. *Muscles situated on the anterior part of the Neck, close to the Vertebræ.*

Longus colli
Rectus capitis internus major
Rectus capitis internus minor
Rectus capitis lateralis

XXIV. *Muscles situated on the posterior part of the Trunk.*

First Layer
Trapezius, seu Cucullaris
Latissimus dorsi
Second Layer
1. On the back
Serratus posticus inferior
Rhomboideus major et minor
2. On the neck
Splenius capitis et colli
3. Single pair
Serratus superior posticus
Third Layer
1. On the back
Spinalis dorsi
Longissimus dorsi
Sacro-lumbalis
2. On the neck
Complexus
Trachelo-mastoideus
Levator scapulæ

FOURTH LAYER

1. On the back

    Semispinalis dorsi
    Multifidus spinæ

2. Posterior part of the neck

    Semispinalis colli
    Transversalis colli

3. Below the posterior part of the occiput

    Rectus capitis posticus major
    Rectus capitis posticus minor
    Obliquus capitis superior
    Obliquus capitis inferior

4. On the side of the neck

    Scalenus anticus
    Scalenus medius
    Scalenus posticus

5. Between the spinous and transverse processes of contiguous vertebræ

    Interspinales colli
    Intertransversales colli
    Interspinales dorsi et lumborum
    Intertransversales dorsi
    Intertransversales lumborum

XXV. *Muscles of the Superior Extremities.*

On the scapula

1. Behind

    Supra-spinatus
    Infra-spinatus
    Teres minor

2. Along the inferior costa of the scapula
 Teres major
3. Before the scapula
 Deltoides
 Coraco-brachialis
4. Beneath the scapula
 Subscapularis

XXVI. *Muscles situated on the Os Humeri.*

1. Before
 Biceps flexor cubiti
 Brachialis internus
2. Behind
 Triceps extensor cubiti
 Anconeus

XXVII. *Muscles situated on the Cubit or Fore-arm*

First Class

Flexors and extensors of the whole hand

1. Flexors
 Palmaris longus
 Palmaris brevis
 Flexor carpi radialis
 Flexor carpi ulnaris
2. Extensors
 Extensor carpi radialis longior
 Extensor carpi radialis brevior
 Extensor carpi ulnaris

SECOND CLASS

Flexors and extensors of the fingers

1. Flexors

Flexor sublimis perforatus

Flexor profundus perforans

Lumbricales

2. Extensors

Extensor digitorum communis

THIRD CLASS

Supinators and pronators, or those that roll the radius on the ulna

1. Supinators

Supinator radii longus

Supinator radii brevis

2. Pronators

Pronator radii teres

Pronator radii quadratus

XXVIII. *Muscles situated on the Hand chiefly*,

1. Muscles of the thumb

Flexors

Flexor longus pollicis manus

Flexor brevis pollicis manus

Flexor ossis metacarpi pollicis, seu Opponens pollicis

Extensors

Extensor ossis metacarpi pollicis manus

Extensor primi internodii

Extensor secundi internodii

Abductor pollicis manus
Adductor pollicis manus
2. Muscles of the fore-finger
Indicator
Abductor indicis manus
3. Muscles of the little finger
Abductor minimi digiti manus
Adductor metacarpi minimi digiti manus
Flexor parvus minimi digiti
4. Muscles between the metacarpal bones
Interossei interni, viz.
Prior indicis
Posterior indicis
Prior annularis
Interosseus auricularis
Interossei externi, seu bicipites, viz.
Prior medii
Posterior medii
Posterior annularis

XXIX. *Muscles of the Inferior Extremities.*

Muscles on the outside of the pelvis, which are called muscles of the thigh
1. Before
Psoas magnus*
Iliacus internus*
Pectinalis

* See Reg. XX.

Triceps adductor femoris, comprehending

Adductor longus femoris

Adductor brevis femoris

Adductor magnus femoris

Obturator externus

2. Behind

First Layer

Gluteus maximus

Second Layer

Gluteus medius

Third Layer

Gluteus minimus

Pyriformis

Gemini

Quadratus femoris

XXX. *Muscles situated on the Thigh.*

1. Outside

Tensor vaginæ femoris

2. Inside

Sartorius

Gracilis

3. Before

Rectus

Vastus externus

Vastus internus

Cruralis

4. Behind

Semitendinosus

Semimembranosus
Biceps flexor cruris
Popliteus

XXXI. *Muscles situated on the Leg.*

First Class

Extensors and flexors of the foot

1. Extensors
   Gastrocnemius externus, seu Gemellus
   Soleus, seu Gastrocnemius internus
   Plantaris

2. Flexors
   Tibialis anticus
   Tibialis posticus
   Peroneus longus
   Peroneus brevis

Second Class

Common extensors and flexors of the toes

1. Common extensors
   Extensor longus digitorum pedis
   Extensor brevis digitorum pedis

2. Flexors
   Flexor brevis digitorum pedis, seu Sublimis perforatus
   Flexor longus digitorum pedis, seu Profundus perforans
   Flexor digitorum accessorius, seu massa carnea Jacobi Sylvii
   Lumbricales pedis

XXXII. *Muscles which are chiefly situated on the Foot.*

1. Muscles of the great toe
    Extensor proprius pollicis pedis
    Flexor longus pollicis pedis
    Flexor brevis pollicis pedis
    Abductor pollicis pedis
    Adductor pollicis pedis
2. Muscles of the little toe
    Abductor minimi digiti pedis
    Flexor brevis minimi digiti pedis
3. Muscles from the metatarsal bones
    Interossei pedis externi
    Bicipites, viz.
        Abductor indicis pedis
        Adductor indicis pedis
        Adductor medii digiti pedis
        Adductor tertii digitii pedis
    Interossei pedis interni, viz.
        Abductor medii digiti pedis
        Abductor tertii digiti pedis
        Abductor minimi digiti pedis
4. Transversalis pedis

In the Second Book of *Historiæ Musculorum*, Albinus, following the same order that he has observed in numbering the regions, has described the relative situations of the muscles as they present themselves on dissection; while Innes, with more conciseness and method, and with more perspicuity, though not with the same accurate minuteness, has endeavoured to communicate the like information, by subdividing many of his regions, and classing his muscles according to their layers. His description of the muscles, in which he first mentions their origin, then their insertion, and at last their uses, is agreeable to the plan of the celebrated Douglas.

This plan, with respect to perspicuity, has many advantages, although it must lead to erroneous conclusions, if the student infer that the origin is always the fixed point, and the insertion always the moveable; for sometimes the one, and sometimes the other, is the moveable point, although the insertion in ordinary cases be more frequently so than the origin. It tends likewise to promote error, by directing the attention chiefly to the opposite extremities of a muscle, and by diverting it from those connections which muscles frequently form in their course with those in their vicinity. Winslow therefore, who dislikes this distinction into origins and insertions, includes both under the general name of attachments.

The attachments of muscles at their extremities,

which are those principally mentioned by Innes, are in most instances conformable to what were observed by Albinus; and this correctness in point of fact, so far as he goes, with his clearness of method and conciseness of description, has rendered his work one of the most popular, convenient, and useful, that has yet been published, for the purposes of dissection.

REGIONS *into which the Muscles are arranged according to* DUMAS.

I. *Region Epicranienne, ou du Crane.*

Occipito-frontal

II. *Frontale, ou du Front.*

Fronto-sourcillier
Cutaneo-sourcillier

III. *Palpebrale, ou des Paupieres.*

Maxillo-palpebral
Orbito-sus-palpebral

IV. *Orbitaire, ou des Orbites.*

Optico-trochlei-scleroticien
Maxillo-scleroticien
Sus-optico-spheni-scleroticien
Sous-opti-spheno-scleroticien
Orbito-intus-scleroticien
Orbito-extus-scleroticien

V. *Auriculaire Externe, ou des Oreilles.*

Temporo-conchinien
Zigomato-conchinien

Mastoïdo-conchinien
Antheli-tragique
Concho-tragique
Helix
Concho-helix
Concho-anthelix

VI. *Auriculaire Interne, ou de l'Ouie.*

Salpingo-malléen
Spheni-salpingo-malléen
Acoustico-malléen
Pyramido-stapedien

VII. *Malaire, ou Laterale de la Face.*

Arcadi-temporo-maxillaire
Zigomato-maxillaire
Alveolo-maxillaire

VIII. *Nasale, ou du Nez.*

Maxillo-labii-nasal
Maxillo-alveoli-nasal
Fronto-nasal
Maxillo-narinal

IX. *Labiale, ou des Levres.*

Orbito-maxilli-labial
Sus-maxillo-labial
Naso-labial
Labial
Sous-maxillo-labial

Grand zigomato-labial
Petit zigomato-labial

X. *Pterigo-maxillaire, ou Interne de la Face.*

Pterigo-anguli-maxillaire
Pterigo-colli-maxillaire

XI. *Maxillaire Inferieure, ou du Menton.*

Mentonier-labial
Sous-maxillo-cutané
Mastoïdo-hygenien

XII. *Trachelo-thorachique, ou Superficielle Anterieure du Cou.*

Thoraco-maxilli-facial
Sterno-clavio-mastoïdien

XIII. *Trachelo-Hyoïdienne, ou Profonde Anterieure du Cou.*

Stylo-hyoïdien
Mylo-hyoïdien
Genio-hyoïdien
Sterno-hyoïdien
Scapulo-hyoïdien
Sterno-thyroïdien
Hyo-thyroïdien

XIV. *Laryngienne, ou du Larynx.*

Crico-thyroïdien
Crico-crêti-arithenoïdien

Crico-lateri-arithenoïdien
Thyro-arithenoïdien
Arithenoïdiens obliques
Arithenoïdien transversal
Thyro-epiglotique
Aritheno-epiglotique
Glosso-epiglotique

XV. *Palatine, ou du Palais.*

Glosso-staphilin
Palato-pharyngien
Petro-salpingo-staphilin
Spheno-salpingo-staphilin
Palato-staphilin

XVI. *Glossienne, ou de la Langue.*

Genio-glosse
Stylo-glosse
Hyo-condro-glosse
Lingual

XVII. *Pharyngienne, ou du Pharynx.*

Stylo-thyro-pharyngien
Petro-salpingo-spheno-pharyngien
Pterigo-syndesmo-staphili-pharyngien
Hyo-glosso-basi-pharyngien
Crico-thyro-pharyngien

XVIII. *Costo-sternale, ou Anterieure du Thorax.*

Sterno-costo-clavio-humeral
Costo-coracoïdien
Costo-claviculaire

XIX. *Spino-costale, ou Laterale du Thorax.*

Costo-basi-scapulaire
Inter-lateri-costaux
Sus-costaux

XX. *Thoraco-pleurale, ou Interne du Thorax.*

Sterno-costal
Inter-pleuri-costaux
Sous-costaux

XXI. *Abdominale, ou de l'Abdomen.*

Ilio-pubi-costo-abdominal
Ilio-lumbo-costi-abdominal
Lumbo-ili-abdominal
Pubio-sternal
Pubio-ombilical

XXII. *Thoraco-abdominale, ou Diaphragmatique.*

Thoraco-abdominal

XXIII. *Dorso-cervicale, ou du Dos et du Cou.*

Occipiti-dorso-clavi-sus-acromien
Cervici-dorso-scapulaire

Cervici-dorso-costal
Trachelo-anguli-scapulaire

XXIV. *Dorso-lombaire, ou du Dos et des Lombes.*

Dorsi-lumbo-sacro-humeral
Dorsi-lumbo-costal

XXV. *Cervico-occipitale, ou Posterieure du Cou et de la Tete.*

Cervico-dorsi-mastoïdien
Dorso-trachelien
Dorsi-trachelo-occipital
Trachelo-mastoïdien
Spini-axoïdo-occipital
Tuber-atloïdo-occipital
Trachelo-atloïdo-occipital
Spini-axoïdo-tracheli-atloïdien

XXVI. *Spinale, ou Posterieure de la Colonne Epiniere.*

Lumbo-costo-trachelien
Lumbo-dorso-trachelien
Lumbo-dorso-spinal
Transverso-spinal
Inter-epineux
Inter-transversaire

XXVII. *Pré-spinale, ou Anterieure de la Colonne Epiniere.*

Grand trachelo-basilaire
Petit trachelo-basilaire

Tranchelo-atloïdo-basilaire
Pré-dorso-cervical
Pré-lumbo-pubien
Pré-lumbo-trochantin

XXVIII. *Transverso-spinale, ou Laterale de la Colonne Epiniere.*

Trachelo-costal
Ilio-lumbi-costal
Ischio-coccigien

XXIX. *Iliaque Externe, ou des Fesses.*

Ilii-sacro-femoral
Ilio-trochanterien
Ilio-ischii-trochanterien
Sacro-ili-trochanterien
Ischio-spini-trochanterien
Intra-pelvio-trochanterien
Tuber-ischio-trochanterien

XXX. *Iliaque Interne, ou du Bassin.*

Iliaco-trochantin
Pubio-coccigi-annulaire
Pubio-coccigi-vesical

XXXI. *Annulaire, ou de l'Anus.*

Coccigio-cutané-sphincter
Recto-cutané-sphincter

XXXII. *Perineo-sexuelle, ou du Periné et des Organes Sexuels.*

Ischio-pubi-prostatique
Ischio-caverneux
Bulbo-syndesmo-caverneux
Pubio-prostatique
Anulo-syndesmo-elitoridien
Ischio-clitoridien

XXXIII. *Scapulaire, ou de l'Epaule.*

Sous-acromio-clavi-humeral
Sus-spini-scapulo-trochiterien
Sous-spini-scapulo-trochiterien
Margini-sus-scapulo-trochiterien
Anguli-scapulo-humeral
Sous-scapulo-trochinien
Coraco-humeral

XXXIV. *Humero-claviculaire, ou Anterieure du Bras.*

Scapulo-coraco-radial
Humero-cubital

XXXV. *Humero-olecranienne, ou Posterieure du Bras.*

Tri-scapulo-humero-olecranien

XXXVI. *Cubito-palmaire, ou Anterieure de l'avant Bras.*

Epitrochlo-radial
Epitrochlo-metacarpien
Epitrochlo-carpi-palmaire
Epitrochlo-coroni-phalanginien
Epitrochli-cubito-carpien
Radio-phalangettien du pouce
Cubito-phalangettien commun
Cubito-radial

XXXVII. *Cubito-olecranienne, ou Posterieure de l'avant Bras.*

Humero-sus-radial
Humero-sus-metacarpien
Epicondylo-sus-metacarpien
Epicondylo-sus-phalangettien commun
Epicondylo-sus-phalangettien du petit doigt
Epicondy-cubito-sus-metacarpien
Epicondylo-cubital
Epicondylo-radial
Cubito-radi-sus-metacarpien du pouce
Cubito-sus-phalangien du pouce
Cubito-sus-phalangettien du pouce
Cubito-sus-phalangettien de l'index

XXXVIII. *Palmaire, ou Interne de la Main.*

Palmaire-cutané
Scapho-sus-phalanginien du pouce
Carpo-phalangien du pouce
Carpo-phalanginien du pouce
Metacarpo-phalanginien du pouce
Carpo-phalangien du petit doigt
Second carpo-phalangien du petit doigt
Carpo-metacarpien du petit doigt
Annuli-tendino-phalangiens
Sous-metacarpo-lateri-phalangiens

XXXIX. *Sus-palmaire, ou Externe de la Main.*

Sus-metacarpo-lateri-phalangiens

XL. *Femoro-peronienne, ou Externe de la Cuisse.*

Ilio-aponeurosi-femoral

XLI. *Femoro-rotulienne, ou Anterieure de la Cuisse.*

Pubio-femoral
Extra-pelvio-pubi-trochanterien
Ilio-crêti-tibial
Ilio-rotulien
Tri-femoro-tibi-rotulien

XLII. *Femoro-pubienne, ou Interne de la Cuisse.*

Sous-pubio-crêti-tibial
Spini-pubio-femoral

Sous-pubio-femoral
Ischio-pubi-femoral

XLIII. *Femoro-poplité, ou Posterieure de la Cuisse.*

Ischio-crêti-tibial
Ischio-popliti-tibial
Ischio-femoro-peronier

XLIV. *Créti-crurale, ou Anterieure de la Jambe.*

Tibio-sus-metatarsien
Peroneo-sus-phalanginien du pouce
Peroneo-tibi-sus-phalangettien commun
Petit-peroneo-sus-metatarsien
Tibi-peroneo-tarsien
Grand peroneo-sus-metatarsien

XLV. *Poplité-crurale, ou Posterieure de la Jambe.*

Bi-femoro-calcanien
Petit femoro-calcanien
Femoro-popliti-tibial
Tibio-peronei-calcanien
Peroneo-phalanginien du gros orteil
Tibio-phalangettien commun
Tibio-tarsien

XLVI. *Sus-plantaire, ou Superieure du Pied.*

Calcaneo-sus-phalangettien commun
Sus-metatarso-lateri-phalangiens

XLVII. *Plantaire, ou Inferieure du Pied.*

Calcaneo-phalanginien commun
Planti-tendino-phalangien
Calcaneo-phalangien du pouce
Tarso-phalangien du pouce
Tarso-metatarsi-phalangien du pouce
Metatarso-phalangien du pouce
Calcaneo-phalangien du petit doigt
Metatarso-phalangien du petit doigt
Sous-metatarso-lateri-phalangiens

In the table of Albinus, the number of regions is only forty-eight, after reckoning separately the two halves of those which are double. In that of Dumas, the number, however, amounts to forty-seven, even reckoning the double regions as single. His motives for dividing, or rather, to use a more accurate expression, for frittering the body into so many parts, are to me incomprehensible. The only obvious consequences that can follow, are an additional burden on the memory, already overloaded, and some more difficulties thrown in the way to retard our progress towards matters of importance.

As this sort of division is arbitrary, and resembles the division of a book into chapters, the numbers and titles of the different chapters in which the muscles of the body are described, are the numbers and titles which Albinus and Innes have assigned to their regions. The proper names which Du-

mas has given to his regions are unnecessary; and not only unnecessary, but in many respects extremely incorrect, and calculated more to mislead and embarrass than afford assistance to either the anatomist or physiologist. His second region differs from the first only as a part differs from the whole. His labial region is so far from containing all the muscles belonging to the lips, that we find them scattered through no less than four different regions. His region denominated from the os malæ contains the temporal and buccinator muscles; the first of which is but slightly connected with either the malar bone or its processes, and the second not at all. This region also, as appears from the synonym, was meant to contain all the muscles that occupy the lateral parts of the face; and yet it contains only three muscles, one of which is situated principally upon the lateral aspect of the cranium. The inferior maxillary region contains only three pairs of muscles; two of the pairs nowise concerned in the motions of the bone from which the region has derived its name, and only an extremity of the third pair to be found within the place where the name of the region would lead us to expect the entire muscles. In some cases his regions are limited to a certain depth; and the region which he calls trachelo-hyoïdien lies beneath the trachelo-thorachique. In short, he is regulated by no fixed principle in imposing these names; classing the muscles sometimes by the or-

gan to which they are attached at one of their extremities, sometimes by the place which they principally occupy, and sometimes by the stratum in which they are arranged.

His names of the muscles are borrowed chiefly from Professor Chaussier, with some alterations, and with some additions which he calls improvements. Chaussier had proposed to name the muscles from their attachments; but when the attachments happened to be numerous, the name was confined to the more remarkable or characteristic. Dumas in his names endeavours to express the whole of the attachments; so that his names, in point of length, exhibit often the appearance of sentences. Chaussier in his names had been aiming at something like a definition; and Dumas at something resembling a description: But names in general differ from both definitions and descriptions; and whether they be descriptive or arbitrary, to facilitate intercourse in speech or in writing they should always be short. It is true, indeed, that terms significant and characteristic are employed by Linnæus to express the classes and orders of plants; but his names of genera, species, and varieties, have no other meaning than what they derive from arbitrary use. When they happen to possess a distinct meaning, arising from their etymons, that meaning is in general disregarded.

In Dumas' names, and in his descriptions, for he had found that descriptions were necessary

notwithstanding his names, most of the vague terms of anatomy, as *superior*, *inferior*, *posterior*, and *anterior*, oeeasionally oecur, to which he has added several that are new, though equally vague; as, *extus*, *intus*, *extra*, *intra*, *præ*, and the French prepositions *sus* and *sous*, that are every where associated with the words of aneient Greece and Rome, in a Frenehified form.

In so far as conjecture may here entitle us to draw a conelusion, the object of this writer, if he had an object, in contriving these names and arrangements, was not, by a temperate spirit of reform, to remove ambiguity, error, and confusion, but, prompted by a desperate rage for innovation, to overturn whatever was established, and to substitute in its place nothing that had not, in shadow or substance, the appearance of novelty. Yet possibly he might be deceiving himself; for at the same time he seems to have been actuated by a zeal for anatomy, and talks with enthusiasm of his improvements, while he is turning light into darkness, and bringing things back, so far as he can, from a certain degree of order and arrangement, to a state of the wildest confusion and anarchy.

His attempts in osteology are still more extravagant than those in the myology: "Dessault (he says) had tried to unite the scalpel of the anatomist with the compass of the geometer; but I (he continues) have pushed these curious speeulations farther, and, with regard to many of the bones, have determined

their figures so geometrically, that any person may construct the like without having ever seen the originals

"Thus I have assigned geometrical figures to the os frontis, by saying, that it is bent from below upwards in the four superior fifths of its surface, so as to form unequal intersecting segments of a circle; and that it is flattened in its inferior fifth, so as to represent lines nearly parallel:—to the parietal bone, by observing, that if four equal triangles be raised on its sides, the rest will be the portion of a sphere formed by the union of several concentric circles; and that its figure will then be an assemblage of concentric circles exhibiting a portion of a sphere in the middle, and which shall be terminated by equal triangles:—to the occipital bone, by shewing, that if it be divided into equal parts, the result will necessarily be unequal rhombs: —to the os spenoides, by making it appear that its figure is almost a perfect cube towards its middle, terminated by angles of unequal magnitude; the extremities of which will be opposed to the crown of the head by the revolution of half a circle, one upon the other.

"I have explained in the same manner (he adds) the figure of the temporal, and the figures of many of the other bones; and have regularly applied the principles of geometry in my descriptions, both in my course of anatomical physiology, and in a separate dissertation on the subject."

These fanciful improvements naturally remind us of the curiosities that are sometimes exhibited in the windows of toy-shops, where the human body, in different attitudes, is made to represent the letters of an alphabet; or of those maps where countries are figured in some one or other of the animal forms, and the principles of anatomy applied to geography. Such strained analogies, when viewed considerately, are so far from being any improvement, that, like conundrums, rebuses, and riddles, they are fitted only to amuse children in their leisure hours. It is much to be regretted, that great talents and literary acquirements, influenced by a freakish whim or a passion, should ever be engaged in such puerile conceits: But wisdom and talent are things very different; the latter implies nothing that is either prudent or temperate, and may therefore be employed indiscriminately in the service of vice, virtue, or folly.

SYNONYMS

OF

ALBINUS, INNES, AND DUMAS.

A

	AL.	IN.	DU.
ABDUCTOR brevis pollicis manus			
Abductor pollicis manus, *Innes*			
Scapho-sus-phalanginien du pouce, *Dumas*	25	28	38
Abductor brevis alter pollicis manus			
Abductor digiti minimi manus, seu auricularis			
Carpo-phalangien du petit doigt...	25	28	38
Abductor digiti minimi pedis			
Calcaneo-phalangien du petit doigt	30	32	47
Abductor indicis manus	25	28	
Abductor longus pollicis manus			
Extensor ossis metacarpi pollicis manus			
Cubito-radi-sus-metacarpien du pouce	24	28	37
Abductor pollicis pedis			
Calcaneo-phalangien du pouce ...	30	32	47
Accelerator			
Accelerator urinæ, seu ejaculator seminis			
Bulbo-syndesmo-caverneux	17	16	32

	AL.	IN.	DU.
Adductor brevis femoris			
Sous-pubio-femoral	27	29	42
Adductor longus femoris			
Spini-pubio-femoral	27	29	42
Adductor magnus femoris			
Ischio-pubi-femoral	27	29	42
Adductor ossis metacarpi digiti minimi manus			
Adductor metacarpi digiti minimi manus			
Carpo-metacarpien du petit doigt	25	28	38
Adductor pollicis manus			
Metacarpo-phalanginien du pouce	25	28	38
Adductor pollicis pedis			
Tarso-metatarsi-phalangien du pouce	30	32	47
Anconeus			
Epicondylo-cubital	24	26	37
Anterior auriculæ			
Zigomato-conchinien	2	2	5
Antitragicus			
Antheli-tragique	6	2	5
Arytænoideus obliquus			
Arithenoïdiens obliques	8	14	14
Arytænoideus transversus			
Arithenoïdien transversal	8	14	14
Attollens auriculam			
Temporo-conchinien	2	2	5
Azygus uvulæ			
Palato-staphilin	8	12	15

B

	AL.	IN.	DU.
Basio-glossus			
Cerato-glossus			
Chondro-glossus			
Hyo-glossus			
Hyo-chondro-glosse	8	9	16
Biceps brachii			
Biceps flexor cubiti			
Scapulo-coraco-radial	23	26	34
Biceps cruris			
Biceps flexor cruris			
Ischio-femoro-peronier	27	30	43
Biventer cervicis *	19		
Biventer maxillæ			
Digastricus			
Mastoido-hygenien	8	9	11
Brachialis internus			
Humero-cubital	23	26	34
Buccinator			
Alveolo-maxillaire	3	6	7

C

Cervicalis descendens †

* *Vide* Complexus, Innes XXIV. et Dorsi-tracheli-occipital, Dumas XXV.

† *Vide* Sacro-lumbalis, Innes XXIV. et Lumbo-costo-trachelien, Dumas XXVI.

	AL.	IN.	DU.
Ciliaris			
Pars orbicularis palpebrarum.......	3		
Circumflexus palati mollis			
Circumflexus, seu tensor palati			
Spheno-salpingo-staphilin............	8	11	15
Cleido-mastoideus }			
Sterno-mastoideus }			
Sterno-cleido-mastoideus			
Sterno-clavio-mastoidien	8	8	12
Coccygeus			
Ischio-coccygien....................	18	19	28
Complexus			
Dorsi-tracheli-occipital	19	24	25
Compressor naris			
Maxillo-narinal	3	5	8
Compressor prostatæ	18		
Constrictor cunni			
Sphincter vaginæ			
Anulo-syndesmo-clitoridien.........	17	18	32
Constrictor inferior pharyngis			
Crico-thyro-pharyngien	8	13	17
Constrictor medius pharyngis			
Hyo-glosso-basi-pharyngien.........	8	13	17
Constrictor superior pharyngis			
Pterigo-syndesmo-staphili-pharyngien................................	8	13	17
Constrictor isthmi faucium			
Glosso-staphilin......................	8	12	15
Coraco-brachialis			
Coraco-humeral	23	25	33

	AL.	IN.	DU.
Coraco-hyoideus			
Omo-hyoideus			
Scapulo-hyoïdien	8	10	13
Corrugator supercilii			
Cutaneo-sourcillier	3	1	2
Cremaster	13	16	
Crico-arytænoideus lateralis			
Crico-lateri-arithenoïdien	8	14	14
Crico-arytænoideus posticus			
Crico-crêti-arithenoïdien	8	14	14
Crico-thyreoideus			
Crico-thyroïdien	8	10	14
Cruralis*	27	30	
Cucullaris			
Trapezius			
Occipiti-dorso-clavi-sus-acromien	19	24	23

D

	AL.	IN.	DU.
Deltoides			
Sous-acromio-clavi-humeral	22	25	33
Depressor alæ nasi			
Depressor labii superioris alæque nasi			
Maxillo-alveoli-nasal	3	6	8
Depressor anguli oris			
Sous-maxillo-labial	3	6	9
Depressor labii inferioris			
Mentonier labial	3	6	11

* *Vide* Tri-femoro-tibi-rotulien, Dumas XLI.

	AL.	IN.	DU.
Epicondylo-sus-phalangettien du petit doigt	24		37
Extensor propius pollicis pedis			
Peroneo-sus-phalanginien du pouce	28	32	44
Externus mallei			
Laxator tympani			
Spheni-salpingo-malléen	7	2	6
F			
Flexor brevis digiti minimi pedis			
Metatarso-phalangien du petit doigt	30	32	47
Flexor brevis digitorum pedis			
Flexor brevis digitorum pedis, sublimis perforatus			
Calcaneo-phalanginien commun	30	31	47
Flexor brevis pollicis manus			
Carpo-phalanginien du pouce	25	28	38
Flexor brevis pollicis pedis			
Tarso-phalangien du pouce	30	32	47
Flexor longus digitorum pedis			
Flexor longus digitorum pedis profundus perforans			
Tibio-phalangettien commun	28	31	45
Flexor longus pollicis manus			
Radio-phalangettien du pouce	24	28	36
Flexor longus pollicis pedis			
Peronco-phalanginien du gros orteil	28	32	45
Flexor parvus digiti minimi manus			
Second carpo-phalangien du petit doigt	25	28	38

G

	AL.	IN.	DU.
Gemellus			
Gastrocnemius externus, seu Gemellus			
Bi-femoro-calcânien	28	31	45
Gemini			
Ischio-spini trochanterien	26	29	29
Genio-glossus			
Genio-hyo-glossus			
Genio-glosse	8	9	16
Genio hyoideus			
Genio-hyoïdien.........................	8	9	13
Gluteus magnus			
Gluteus maximus			
Ilii-sacro-femoral......................	26	29	29
Gluteus medius			
Ilio-trochanterien	26	29	29
Gluteus minor			
Gluteus minimus			
Ilio-ischii trochanterien	36	29	29
Gracilis			
Sous-pubio-crêti-tibial...............	27	30	42

H

Hyo-thyreoideus			
Thyreo-hyoideus			
Hyo-thyroïdien.........................	8	10	13

I

Iliacus internus			
Illiaco-trochantin......................	16	29	30

	AL.	IN.	DU.
Indicator			
Cubito-sus-phalangettien de l'index	24	28	37
Infra-spinatus			
Sous-spini-scapulo-trochiterien......	22	25	33
Intercostales externi			
Inter-lateri-costaux	20	22	19
Intercostales interni			
Inter-pleuri-costaux..................	20	22	20
Interossei externi digitorum manus			
Interossei externi, seu bicipites			
Sus-metacarpo-lateri-phalangiens	25	28	39
Interrossei externi digitorum pedis			
Interrossei pedis externi, seu bicipites			
Sus-metatarso-lateri-phalangiens...	30	32	46
Interossei interni digitorum manus			
Sous-metacarpo-lateri-phalangiens	25	28	38
Interossei interni digitorum pedis			
Sous-metatarso-lateri-phalangiens	30	32	47
Interspinales cervicis			
Interspinales colli			
Interepineux	19	24	20
Interspinales dorsi			
Lumbo-dorso-spinal	19		26
Interspinales lumborum.............	19	24	
Intertransversarii dorsi			
Intertransversales dorsi	19	24	
Intertransversarii lumborum			
Intertransversales lumborum.....	19	24	
Intertransversarii posteriores colli			
Intertransversarii priores colli			

	AL.	IN.	DU.
Intertransversales colli			
Intertransversaires	21	24	26

L

	AL.	IN.	DU.
Latissimus colli			
Musculus cutaneus, vulgo platysma myoides			
Thoraco-maxilli-facial	8	8	12
Latissimus dorsi			
Dorsi-lumbo-sacro-humeral	19	24	24
Laxator tympani			
Acoustico-malléen	7		6
Levator anguli oris			
Sus maxillolabial	3	6	9
Levator ani			
Pubio-coccigi-annulaire	18	17	30
Levatores breviores costarum			
Levatores longiores costarum			
Sur-costaux	19		20
Levator labii superioris			
Levator labii superioris alæque nasi			
Orbito-maxilli-labial	3	6	9
Levator menti			
Levator labii inferioris			
Sous-maxillo-cutané	3	6	11
Levator palati mollis			
Levator palati			
Petro-salpingo-staphilin	8	11	15
Levator palpebræ superioris			
Orbito-sus-palpebral	5	3	3

O

	AL.	IN.	DU.
Obliquus externus abdominis			
Obliquus descendens externus			
Ilio-pubi-costo-abdominal	12	15	21
Obliquus inferior capitis			
Spini-axoïdo-tracheli-atloïdien	19	24	25
Obliquus inferior oculi			
Maxillo-scleroticien	5	4	4
Obliquus internus abdominis			
Obliquus ascendens internus			
Ilio-lumbo-costi-abdominal	12	15	21
Obliquus superior capitis			
Trachelo-atloïdo-occipital.........	19	24	25
Obliquus superior oculi			
Obliquus superior oculi, seu trochlearis			
Optico-trochlei-scleroticien	5	4	4
Obturator externus			
Extra-pelvio-pubi-trochanterien	27	29	41
Obturator internus			
Intra-pelvio-trochanterien	26	19	29
Opponens pollicis manus			
Flexor ossis metacarpi pollicis, seu opponens pollicis			
Carpo-phalangien du pouce	25	28	38
Orbicularis oris			
Labial	3	6	9
Orbicularis palpebrarum			
Maxillo-palpebral	3	3	3

P

	AL.	IN.	DU.
Pronator teres			
Pronator radii teres			
Epitrochlo-radial	24	27	36
Psoas magnus			
Pré-lumbo-trochantin	16	29	27
Psoas parvus			
Pré-lumbo-pubien	16	20	27
Pterygoideus externus			
Pterigo-colli-maxillaire	9	7	10
Pterygoideus internus			
Pterigo-anguli-maxillaire	9	7	10
Pyramidalis			
Pubio-ombilical	12	15	21
Pyriformis			
Sacro-ili-trochanterien	26	29	29

Q

	AL.	IN.	DU.
Quadratus femoris			
Tuber-ischio-trochanterien	26	29	29
Quadratus lumborum			
Ilio-lumbi-costal	16	20	28

R

	AL.	IN.	DU.
Radialis externus brevior			
Extensor carpi radialis brevior			
Epicondylo-sus-metacarpien	24	27	37
Radialis externus longior			
Extensor carpi radialis longior			
Humero-sus-metacarpien	24	27	37

	AL.	IN.	DU.
Radialis internus			
Flexor carpi radialis			
Epitrochlo-metacarpien	24	27	36
Rectus abdominis			
Pubio-sternal	12	15	21
Rectus abducens oculi			
Abductor oculi			
Orbito-extus-scleroticien	5	4	4
Rectus adducens oculi			
Adductor oculi			
Orbito-intus-scleroticien	5	4	4
Rectus attollens oculi			
Levator oculi			
Sus-optico-spheni-scleroticien	5	4	4
Rectus deprimens oculi			
Depressor oculi			
Sous-opti-spheno-scleroticien	5	4	4
Rectus cruris			
Rectus			
Ilio-rotulien	27	30	41
Rectus internus major capitis			
Grand trachelo-basilaire	21	23	27
Rectus internus minor capitis			
Petit trachelo-basilaire	21	23	27
Rectus lateralis capitis			
Trachelo-atloïdo-basilaire	21	23	27
Rectus posicus major capitis			
Spini-axoïdo-occipital	19	24	25
Rectus posticus minor capitis			
Tuber-atloïdo-occipital	19	24	25

	AL.	IN.	DU.
Retrahentes auriculæ			
Mastoïdo-conchinien	2	2	5
Rhomboideus major			
Rhomboideus minor			
Cervici-dorso-scapulaire	19	24	23

S

Sacro-lumbalis			
Lumbo-costo-trachelien	19	24	26
Salpingo-pharyngeus			
Petro-salpingo-spheno-pharyngien	8		17
Sartorius			
Ilio-crêti-tibial	27	30	41
Scalenus medius			
Scalenus posticus			
Scalenus prior			
Scalenus anticus			
Trachelo-costal	21	24	28
Semimembranosus			
Ischio-popliti-tibial	27	30	43
Semispinalis dorsi			
Transverso-spinal	19	24	26
Semitendinosus			
Ischio-crêti-tibial	27	30	43
Serratus anticus			
Pectoralis minor			
Costo-coracoïdien	10	21	18
Serratus magnus			
Costo-basi-scapulaire	11	21	19

	AL.	IN.	DU.
Serratus posticus inferior			
Dorsi-lumbo-costal	19	24	24
Serratus posticus superior			
Cervici-dorso-costal	19	24	23
Soleus			
Soleus, seu gastrocnemius internus			
Tibio-peronei-calcanien	28	31	45
Sphincter ani externus			
Sphincter ani			
Coccigio-cutané-sphincter	18	17	31
Sphincter ani internus			
Recto-cutané-sphincter	18		31
Spinalis cervicis			
Semispinalis colli			
Transverso-spinal	19	24	26
Spinalis dorsi			
Lumbo-dorso-spinal	19	24	26
Splenius capitis			
Cervico-dorsi-mastoïdien			
Splenius colli			
Dorso-trachelien			
Splenius			
Stapedius			
Pyramido-stapedien	7	2	6
Sterno-hyoideus			
Sterno-hyoïdien	8	10	13
Sterno-mastoideus			
Vide cleido-mastoideus	8	8	12
Sterno-thyreoideus			
Sterno-thyroïdien	8	10	13

	AL.	IN.	DU.
Stylo-glossus			
Stylo-glosse	8	11	16
Stylo-hyoideus			
Stylo-hyoïdien	8	11	13
Stylo-hyoideus alter	8		
Stylo-pharyngeus			
Stylo-thyro-pharyngien	8	11	17
Subclavius			
Costo-claviculaire	10	21	18
Sublimis			
Flexor sublimis perforatus			
Epitrochlo-coroni-phalanginien	24	27	36
Subscapularis			
Sous-scapulo-trochinien	22	25	33
Supinator brevis			
Supinator radii brevis			
Epicondylo-radial	24	27	37
Supinator longus			
Supinator radii longus			
Humero-sus-radial	24	27	37
Supraspinatus			
Sus-spini-scapulo-trochiterien	22	25	33

T

	AL.	IN.	DU.
Temporalis			
Arcadi-temporo-maxillaire	4	7	7
Tensor tympani			
Salpingo-malleen	7	2	6
Tensor vaginæ femoris			
Ilio-aponeurosi-femoral	27	30	40

	AL.	IN.	DU.
Teres major			
Anguli-scapulo-humeral	22	25	33
Teres minor			
Margini-sus-scapulo-trochiterien	22	25	33
Thyreo-arytænoideus			
Thyro-arithenoïdien	8	14	14
Thyreo-arytænoideus alter minor.........	8		
Thyreo-epiglottideus			
Thyro-epiglotique		14	14
Tibialis anticus			
Tibio-sus-metatarsien	28	31	44
Tibialis posticus			
Tibio-tarsien	28	31	45
Trachelo-mastoideus			
Trachelo-mastoïdien	19	24	25
Tragicus			
Concho-tragique	6	2	5
Transversalis cervicis			
Transversalis colli.....................	19	24	
Transversus abdominis			
Transversalis			
Lumbo-ili-abdominal	12	15	21
Transversus auriculæ			
Concho-anthelix	6	2	5
Transversus perinei			
Ischio-pubi-prostatique	18	16	32
Transversus perinei alter			
Ischio-pubi-prostatique	18	16	32

	AL.	IN.	DU.
Triangularis sterni			
Triangularis, seu sterno-costalis			
Sterno-costal	15	22	20
Triceps brachii			
Triceps extensor cubiti			
Tri-scapulo-humero-olecranien	23	26	35

V

Vastus externus Cruralis Vastus internus	Tri-femoro-tibi-rotulien

U

	AL.	IN.	DU.
Ulnaris externus			
Extensor carpi ulnaris			
Epicondy-cubito-sus-metacarpien	24	27	37
Ulnaris internus			
Flexor carpi ulnaris			
Epitrochli-cubito-carpien	24	27	36

Z

	AL.	IN.	DU.
Zygomaticus major			
Grand zigomato-labial	3	6	9
Zygomaticus minor			
Petit zigomato-labial	3	6	9

SYNONYMS

PRIOR TO THE

TIME OF ALBINUS.

ALBINUS, with great learning and industry, has published these synonyms in his Third Book of *Historia Musculorum.* The principal authors whom he has quoted are here arranged in the order of time; and the reason why earlier writers than Vesalius are seldom referred to, is, that Vesalius was among the last, and decidedly the greatest, of the anatomists who were accustomed to distinguish the muscles by descriptions and numbers, rather than by names.

This table will be useful as a key to most of the writers who have treated of myology, from the middle of the sixteenth to nearly the middle of the eighteenth century, that is, from the time of Vesalius to Albinus; and should the reader peruse it with attention, he will perceive many of the difficulties with which anatomists had to contend in improving this part of their science, and be made sensible of many obligations that are laid upon him to speak of their errors with lenity and indulgence, and to mention their names with gratitude and respect.

The Names of these Authors, with the Periods at which they began to flourish.

Sylv.	Sylvius 1539	De Mar.	De Marchett 1652
Ves.	Vesalius 1543	Lower	Lower 1665
Valverd.	Valverda.... 1556	De Graaf	De Graaf... 1668
Col.	Columbus... 1559	Molin.	Molinetti... 1669
Fal.	Fallopius ... 1561	Steno	Steno...... 1669
Eust.	Eustachius 1563	Du Ver.	Du Verney 1675
Coiter.	Coiterus.... 1566	C. Barth.	C. Bartholine 1675
Arant.	Arantius ... 1595	Dionis	Dionis 1683
Laur.	Laurentius .. 1595	Vieus.	Vieussenius 1684
Cas.	Casserius ... 1600	Verheyen	Verheyen .. 1693
Fabric.	Fabricius ... 1602	Cowp.	Cowper 1694
Riol.	Riolanus.... 1607	Littre	Littre 1700
Spig.	Spigelius ... 1626	Valsalv.	Valsalva 1704
Bucret.	Bucretius... 1627	Sant.	Santorini.... 1705
T. Barth.	T. Bartholine 1641	Morg.	Morgagni... 1706
Vesling.	Veslingius... 1641	Doug.	Douglas.... 1707
Drake	Drake 1641	Heist.	Heister..... 1711
Diemer.	Diemerbroek 1649	Win.	Winslow.... 1719
High.	Highmore .. 1651	Senac	Senac...... 1724
Pecquet	Pecquet 1651	Monro	Monro 1733

A

Abductor brevis pollicis manus

Qui pollicem maxime abducit, *Ves.*

Septimus extremæ manus musculus, *Col.*

Septimus, *Fal.*

Pars thenaris, *Riol.*

Abducens pollicem, *Spig.*

Abductor pollicis, *Cowp. Doug.*

Pars ejus qui le thenar, *Win.*

Abductor digiti minimi manus

Vigesimus manus digitos moventium, *Ves.*

Sextus extremæ manus musculus, *Col.*

Pars hypothenaris parvi digiti, *Riol.*
Minimum digitum abducens, *Spig.*
Pars abductoris minimi digiti, *Cowp.*
Extensor tertii internodii minimi digiti, *Doug.*
L'hypothenar du petit doigt, *Win.*

Abductor digiti minimi pedis
Decimus septimus pedis digitos moventium, *Ves.*
Tertius musculus digitis pedis inserviens, *Col.*
Parvus musculus ad latus minimi, *Fal.*
Musculus minimo digito abducendo dicatus, *Cas.*
Abductor minimi digiti, *Riol. Cowp. Doug.*
Minimum abducens, *Spig.*
Le metatarsien, una cum eo qui le grand parathenar, *Win.*

Abductor indicis manus
Alter musculus, lateralibus pollicis motibus inserviens, *Ves.*
Septimus pollicis musculus, *Col.*
Primus, *Fal.*
Abductor indicis, *Riol. Doug.*
Adducens pollicem, *Spig.*
Adductor pollicis, *Cowp.*
Le demi-interosseux de l'index, *Win.*

Abductor longus pollicis manus
Vigesimus-secundus digitos moventium, una cum vigesimi-tertii portione, cujus tendo in primi pollicis ossis radicem implantatur, *Ves.*

Quinti manus exterioris musculi, *Col.* pars quæ ad primum pollicis articulum procedit, una cum ea quæ ad os brachialis, quo pollex sulcitur.

Secundi et tertii pollicis internodii extensoris, *Spig.* superior portio, una cum inferioris portione, cujus tendo radici primi pollicis internodii adnascitur.

Extensor primi internodii ossis pollicis, *Cowp. Doug.*

Pars ejus, qui le premier extenseur du pouce, illa autem, qui s'attache au bord de la base de la premiere phalange, *Win.*

Abductor pollicis pedis

Decimus-octavus pedis digitos moventium, *Ves.*

Secundus pedis musculus digitis inserviens, pollicem ab aliis digitis deducens, *Col.*

Parvus musculus ad latus pollicis, *Fal.*

Pollicem adducens, *Cas. Spig.*

Abductor pollicis, *Riol. Cowp. Doug.*

Pars ejus qui le thenar, *Win.*

Accelerator

Primus penis musculus, *Ves. Col. Laur.*

Accelerator, *Riol. Morg. Sant.*

Inferior, sive urethram trahens, *Spig.*

Dilatator urethræ, sive accelerator seminis et urinæ, *De Mar.*

Urethram dilatans, *De Graaf.*

Accelerator urinæ, *Cowp. Doug.*
Le Bulbo-caverneux, *Win.*
Adductor brevis femoris
Pars quinti femur moventium, *Ves.*
Pars octavi femoris musculi, *Col.*
Secunda pars quinti femur moventium, *Fal.*
Alterum caput tricipitis, *Riol.*
Pars flectentium tertii, *Spig.*
Pars tricipitis, *Cowp.*
Adductor femoris secundus, *Doug.*
Le second muscle du triceps, *Win.*
Adductor longus femoris
Pars octavi femur moventium, *Ves.*
Fortasse pars septimi femoris musculi, *Col.*
Pars prima quinti femur moventium, *Fal.*
Primum caput tricipitis, *Riol.*
Pars flectentium tertii tricipitis, *Spig.*
Pars tricipitis, *Cowp.*
Adductor femoris primus, *Doug.*
Le premier muscle du triceps, *Win.*
Adductor magnus femoris
Pars quinti femur moventium, *Ves.*
Pars octavi femoris musculi, *Col.*
Tertia pars cum quarta quinti moventium femur, *Fal.*
Tertium caput tricipitis, *Riol.*
Pars flectentium tertii, tricipitis, *Spig.*
Pars tricipitis, *Cowp.*
Adductor femoris tertius cum quarto, *Doug.*
Le troisieme muscle du triceps, *Win.*

Adductor ossis metacarpi digiti auricularis

Illorum octo, qui quatuor subserviunt digitis, parvum digitum flectentium primus, *Ves.*

Unus octo aliorum musculorum, &c. *Col.*

Unus illorum octo qui inter ossa metacarpi continentur, *Fal.*

An pars hypothenaris parvi digiti, *Riol?*

Interosseus ultimo ossi metacarpi parte manus externa adhærens, *Spig.*

Pars abductoris minimi digiti, *Cowp.*

Flexor primi internodii minimi digiti, *Doug.*

L'adducteur oblique du quatrieme os du metacarpe, *Win.*

Le metacarpien, *Ejusd.*

Adductor pollicis manus

Trium qui secundo pollicis ossi famulantur primus, *Ves.*

Pars musculi pollicem flectentis volam versus, *Col.*

Secundus, *Fal.*

Pars hypothenaris pollicis, *Riol.*

Est haud dubie secundi internodii pollicis flexor primus, *Spig.*

Pars flexoris primi et secundi ossis pollicis, *Cowp.*

Adductor(pollicis)ad minimum digitum,*Doug.*

Pars ejus qui le meso-thenar, *Win.*

Adductor pollicis pedis

Vide musculos primos articulos flectentes, qui tertium musculum in numero succedunt, *Ves.*

Decem musculos singulis digitis pedis binos inservientes, *Col.*

Parvos musculos quorum quatuor collocantur in planta, *Fal.*

An huc pertinent musculi in pedio ab ipsius ossibus orti, *Sylv.?*

Alius musculus transversus, *Riol.*

Interosseus, *Spig.*

Interosseus ad indicem pertingens, *Bucret.*

Adductor pollicis, *Cowp. Doug.*

Pars ejus, qui l'antithenar, *Win.*

Anconeus

Angoneus, *Riol.*

Anconæus, *Cowp.*

Angoneus vel cubitalis, *Riol. Doug.*

Le petit ancone, *Win.*

Anterior auriculæ

Auriculæ musculus anterior, *Valsalv.*

L'anterieur, *Vieus.*

Musculus novus conchæ proprius, *Sant.*

L'anterieur de l'oreille, *Win.*

Antitragicus

Musculus antitragi, *Valsalv. Sant.*

Arytænoideus obliquus

An paris crico-arytænoïdis superioris, *Verheyen?*

De quo *Morg.* quæ vero post has locantur, sæpe in plures junctæ fasciculos, &c.

Arytænoideus minor, *Doug.*

An ad eum pertinet arytæno-epyglotteus, *Pauli?*

Paris thyro-arytænoidis obliqui, *Sant.* una cum ary-epiglottideo.

L'arytenoïdien croisé
Le crico-arytenoïdien superieur,
An huc etiam pertinet l'aryteno-epiglotique? } *Win.*

Arytenoideus transversus

Propriorum laryngis undecimus ac duodecimus, *Ves.*

Musculus extremus laryngis omnium minimus, *Col.*

Sextum par a Vesalio, *Fal.*

Alii duo, qui ipsius arytenoidis musculi proprii censentur, *Fabric.*

Musculus laryngis conjuge destitutus,
Tertius semicircularis, } *Cas.*

Flectens ad latera, sive claudens secundum par, arytænoideum, *Spig.*

Secundum par arytænoides dictum, *Vesling.*

Exile par, quod arytænoidum proprium dicitur, *De Mar.*

Arytenoideus, *Riol. Cowp.*

De quo *Morg.* porro in nobis quæ earum fibrarum anticæ, seu interiores sunt, &c.

Arytænoideus major, *Doug.*

Ary-arytænoidis fibræ interioris, *Sant.*

L'arytænoïdien transversal, *Win.*

Attollens auriculam

Auriculæ primus, *Fal.*

Primus propriorum auriculæ, *Cas.*

Portio musculi frontalis supra crotaphitam ad aurem producti, *Riol.*

Attollens auriculæ, *Spig.*

Le premier de l'oreille, *Du Verney.*

Attollens auriculam, *Cowp.*

Superior auriculæ, *Valsalv. Sant.*

Le premier et le second mitoyen, *Vieus.*

Le superieur de l'oreille, *Win.*

Azygus uvulæ

Sunt de quibus *Dionis*, la luette est composée de deux petits muscles ronds qui viennent de la cloison du nez.

Columellæ musculus teres, } *Morg.*
Azygos, }

Palato-staphilinus, *Doug.*

Le muscle de la luette, *Littre.*

Uvulæ azygos Morgagni, } *Heist.*
Azygus Morgagni, }

Uvulæ azygus, *Sant.*

Les staphylins ou epistaphylins, } *Win.*
Les staphylins ou epistaphylins moyens, }

B

Basio-glossus

Videtur esse pars tertii et quarti linguæ musculorum, *Ves.*

Haud dubie pars secundi paris linguæ, *Fal.*

Itemque secundi paris propriorum linguæ; *Arant.*

Et tertii linguæ musculorum paris, *Cas.*

Pars basio-glossi, *Riol.*

Videtur et pars quinti paris deprimentis, sive cerato-glossi, *Spig.*

Cerato-glossi pars, named bassio-glossus, *Doug.*

Pars cerato-glossi, *Morg.*

Basio-glossus, *Cowp.*

Le basio-glosse, pars ejus qui le hyo-glosse, *Win.*

Biceps brachii

Primus flectentium cubitum, præter carnosam partem interioris principii, &c. *Ves.*

Primus cubitum flectens, vulgo ab Italis dictus *il pescetto*, præter alterius initii carnosam partem, *Col.*

Biceps, *Riol. Cowp.*

Cubitum flectentium primus, præter carnosam portionem in humeri medium insertam, *Spig.*

Biceps manus, *Steno.*

Biceps internus, *Doug.*

Le biceps du bras,
Le biceps ou le coraco-radial, } *Win.*

Biceps cruris

Quartus tibiam moventium, *Ves.*

Quintus tibiæ musculus, *Col.*

Biceps, *Riol. Cowp.*

Flectentium tibiam quintus, biceps, *Spig.*

Le biceps de la jambe, } *Win.*
Le biceps,

Biventer cervicis

Secundi paris caput moventium, primus musculus, cum secundo, *Ves.*

Pars secundi musculi capitis, *Col.*

Secundi moventis caput, *Fal.* Vide *Eustach.* de motu cap. qui hos (a recentioribus anatomicis ante alios descriptos) sequuntur, &c.

Pars complexi, *Riol. Cowp. Doug.*

Primus musculus, cum secundo, trigemini, aut compositi, *Spig.*

Pars ejus qui le complexus, *Win.*

Biventer maxillæ

Alterius lateris maxillam moventium quartus, *Ves.*

Maxillæ inferioris quartus os aperiens, *Col.*

Quarti maxillæ paris, *Arant.*

Digastricus, *Riol. Doug. Morg. Sant.*

Alterius paris maxillæ, deprimentis biventris, *Spig.*

Paris digastrici, sive biventris, *Vesling.*

Digastricus, seu biventer, *Cowp.*

Le digastrique, *Win.*

The digastric, *Monro*, Med. Ess.

Brachialis internus

Secundus, seu cubitum flectentium posterior, *Ves.*

Secundus cubitum flectens, *Col.*

Brachieus internus, *Riol. Cowp.*

Cubitum flectentium secundus, brachieus vocatus, *Spig. De Mar.*
Brachialis internus, *Doug.*
Le brachial, *Win.*

Buccinator

Buccarum, labrorum, et nasi alarum, secundus alterius lateris, *Ves.*
Musculus buccæ, *Col.*
Bucco, *Riol.*
Contrahens communis buccarum labiorumque, *Spig.*
Buccinator, *Cowp. Doug. Sant.*
Le buccinateur, *Win.*

C

Cerato-glossus

Videtur esse pars tertii et quarti linguæ musculorum, *Ves.*
Secundi paris linguæ, *Fal.*
Secundi paris propriorum linguæ, *Arant.*
Tertii linguæ musculorum paris, *Cas.*
Pars basioglossi, *Riol.*
Est quinti paris, deprimentis, sive cerato-glossi, *Spig.*
Cerato-glossus, *Cowp.*
Cerato-glossi pars, quæ properly the cerato-glossus, *Doug.*
Pars cerato-glossi, *Morg.*
Le kerato-glosse, pars ejus qui le hyo-glosse, *Win.*

Ad hunc quoque, aut potius fortasse ad basio-glossum, pertinet le chondro-glosse *Ejusd.*

Cervicalis descendens

Secundi paris dorsi musculorum secundum principium a costa, *Fal.*

Pars superior cervicalis descendentis, *Diemer.*

Sacrolumbalis pars superior, *Cowp.*

Cervicalis descendens Diemer. *Doug.*

Sacrolumbi ea superior pars, quam Diemerbrockius cervicalem descendentem musculum vocat, *Morg.*

Le transversaire grele, ou transversaire collateral du col, *Win.*

Chondro-glossus

Paris chondro-glossi, vel ceratio-glossi, Latine corniculo-lingualis *Verheyen.*

Fortasse et chondro-glossus, *Valsalv.*

An chondro-glossus, *Doug.*? in cerato-glosso

Circumflexus palati mollis.

Primi paris musculorum, qui faucibus dilatandis aut constringendis inserviunt, *Fal.*

Ptery-staphylinus externus, *Riol.*

Primi paris dilatantis fauces, quod aliquibus sphæno-pharyngeum dicitur, *Spig.*

Paris pterygo-staphylini externi, *De Mar.*

Pterigo-palatinus, seu sphæno-pterigo-palatinus } *Cowp.*
Pterigo-staphylinus }

Novus tubæ Eustachianæ musculus, *Valsalv.*

Musculus tubæ novus, Valsalv. vel palato-salpingæus, *Doug.*

Pterigo-staphylinus, *Drake.*

Pterigo-palatinus, *Morg.*

Musculus tubæ novus, *Sant.*

Le spheno-salpingo-staphylin, *Win.*

Pars ejus quæ pertinet ad palatum est le spheno-staphylin, et le spheno-salpingo-staphylin, ou salpingo-staphylin externe, *Win.* ad quem pertinet le pterigo-staphylin superieur

Pars quæ ad processum pterigoideum, est le pterigo-salpingoïdien, *Win.*

Cleidomastoideus

Musculi a pectoris osse et clavicula in caput inserti pars a clavicula pronata, *Ves.*

Pars eadem, septimi caput moventis, *Col.*

Eadem septimi paris, eorum qui caput movent, *Eust.*

Eadem mastoidei, *Riol. Spig. Cowp.*

Mastoidei, *Doug.*

Eadem ejus qui le sterno-mastoïdien, ou mastoïdien anterieur, *Win.*

Coccygeus

An quintus levator ani, *Riol.?*

Coccygæus, *Doug.*

Musculus coccygis, *Drake, Cowp.*

Levator coccygis, *Morg.*

Triangularis coccygis, *Sant.*

Le sacro-coccygien, ou coccygien posterieur, *Win.*

Complexus

Secundi paris caput moventium, quartus musculus, moles carnea, *Ves.*

Pars secundi musculi capitis, *Col.*

Secundi moventis caput, *Fal.*

Pars complexi, *Riol. Cowp. Doug.*

Carnea quædam moles quæ trigemino adjungitur, *Spig.*

Pars ejus qui le complexus, *Win.*

Compressor naris

Est de quo *Fallopius,* alium præterea invenio musculum carneum, &c.

An parvus nasi musculus, *Cas.*: qui est alius externus, qui alam naris dilatat sine elevatione nasi, *Riol.*: et primi paris constringentium alas, *Spig.*?

Elevator alæ nasi, *Cowp.*

De quo, *Morg.* Itaque animadvertimus in Eustachii tabulæ, &c.

Transversus, *Sant.*

Videtur esse le transversal, ou inferieur, *Win.*

Compressor prostatæ

Prostatæ levatoris, seu adductoris, pars unius lateris, *Sant.*

Le prostatique superieur, *Win.*

Constrictor cunni

An est orbicularis musculi, suis fibris carneis, sinum (muliebrem) undequaque obvolventis, *Arant.* pars unius lateris?

Est clitoridis inferior latus et planus, *Riol.*

Portio carnosa in externa parte ipsius vaginæ, *De Mar.*

Alius musculorum paris, quod clitoridi a plerisque adscribitur, *De Graaf.*

Vaginæ musculi constrictorii, *Verheyen*, pars unius lateris.

Eadem sphincteris vaginæ, *Cowp.*

The second muscle belonging to the clitoris, *Doug.*

Sphincteris vaginæ, *Sant.* pars unius lateris.

L'autre muscle du clitoris, *Win.*

Constrictor pharyngis inferior

Pars ejus quæ oritur a thyreoidea est communium laryngis musculorum quintus et sextus, *Ves.*

Oesophagum complectentis, *Col.* pars unius lateris

Tertii paris musculorum, qui faucibus dilatandis aut constringendis interviunt, *Fal.* pars inserta in primam cartilaginem laryngis.

Ipse totus est communium laryngis musculorum tertii paris, *Fabric.*

Pars quæ a thyreoidea, œsophagum ambientis, *Cas.* pars unius lateris

Eadem quarti faucium, quem œsophageum vocant, *Laur.*

Eadem œsophagei, *Riol.*

Primi paris constringentium fauces, œsopha-

giæi, *Spig.* et secundi paris, cephalo-pharyngei, pars in thyroidem cartilaginem inserta

Ipse totus, sphincteris, seu œsophagei, *De Mur.* pars unius lateris

Pars quæ a thyreoidea, œsophagei, seu sphincteris gulæ, *Cowp.* pars unius lateris

Paris thyro-pharyngei, *Valsalv.*

Pharyngei pars quæ thyreo-pharyngeus, Vals.

Thyro-pharyngeus, *Morg.*

Pars œsophagei, seu sphincteris gulæ, *Cowp.*

Thyro-pharyngeus, *Sant.*

Le thyro-pharyngien, *Win.*

Pars quæ a cricoidea, est crico-pharyngeus, *Valsalv.*

Pharyngei pars, quæ crico-pharyngeus, Vals. *Doug.*

Pars œsophagei, seu sphincteris gulæ, *Cowp.*

Crico-pharyngeus, *Sant.*

Le crico-pharyngien, *Win.*

Constrictor pharyngis medius

Hujus pars, quæ a cornu hyoidis oritur, est tertii paris musculorum, qui faucibus dilatandis aut constringendis inserviunt, *Fal.* pars inserta in hyoidis latera

Pars tertii faucium, *Laur.*

Pars cephalo-pharyngei, *Riol.*

Secundi paris faucium, cephalo-pharyngei, pars in hyoidis latera inserta, *Spig.*

Pterigo-pharyngei, *Cowp.* pars quæ oritur from the extremities of the os hyoides

Ipse totus est paris hyo-pharyngei, *Valsalv.*

Pars quæ a cornu, pharyngæi, *Doug.* pars quæ hyo-cerato-pharyngæus

Pars quæ ab ossiculo graniformi, pharyngæi, *Doug.* pars quæ chondro-pharyngæus

Ipse totus, pterigo-pharyngei, *Drake*, pars quæ from the os hyoides

Hyo-pharyngeus, *Morg. Sant.*

Pars œsophagæi, seu sphincteris gulæ, *Cowp.*

Le hyo-pharyngien, *Win.*

Pars inserta ossi occipitis est pharyngei, *Doug.* pars quæ cephalo-pharyngeus

Pharyngis musculi solitarii, seu azygi, *Sant.*

Le cephalo-pharyngien, *Win.*

Constrictor pharyngis superior

Pars ejus quæ oritur a maxilla inferiore. An est septimus et octavus linguæ musculorum, *Ves.* ?

Nonus ac decimus linguæ musculus, *Col.* ?

Primi paris propriorum linguæ, *Arant.* ?

Milo-glossus, *Riol.* 1618 et 1626? quem præteriit ann. 1649?

Quarti paris linguæ, attollentis, mylo-glossi, *Spig.* ?

Paris mylo-glossi, *Vesling.* ? *De Mar.* ?

Paris mola-lingualis, *Verheyen* ?

Est pharyngæi, *Doug.* pars quæ mylo-pharyngeus.

An mylo-glossus, *Morg?*

Oesophagæi, seu sphincteris gulæ, *Cowp.* pars quæ oritur ab inferiore maxilla.

Paris mylo-pharyngæi, *Sant.*

Haud dubie le mylo-glosse, *Win.*

Pars quæ a lingua, tertii paris musculorum, qui faucibus dilatandis aut constringendis inserviunt, *Fal.* pars quæ inseritur in radicem linguæ

Pterigo-pharyngei, *Cowp.* pars quæ oritur from the root of the tongue.

Paris glosso-pharyngei, *Valsalv.* aut pars ejus.

Pharyngei, *Doug.* pars quæ glosso-pharyngeus.

Pterigo-pharyngei, *Drake,* pars quæ from the side of the tongue

Oesophagei, *Cowp.* quæ oritur a radice linguæ.

Paris glosso-pharyngei, *Sant.*

Le glosso-pharyngien, *Win.*

Pars quæ a processu pterigoideo, fortasse est spheno-pharyngeus, *Vesling.*

Et paris spheno-pharyngæi, sive pterigo-pharyngei, *De Mar.*

Est pterigo-pharyngei, *Cowp.* pars quæ oritur from the pterigoidal processes of the os cuneiforme

Pharyngæi, *Doug.* pars quæ pterigo-pharyngeus.

Pterigo-pharyngei, *Drake,* pars quæ from the processus pterigoides.

Est paris pterigo-pharyngei, *Morg. Sant.*

Oesophagei, *Cowp.* pars quæ oritur a processu pterigoideo.

Le pterigo-pharyngien, *Win.*

Pars quæ a tendine circumflexi œsophagæi, *Cowp.* pars quæ a tendine pterigo-staphylini.

Pars quæ a genio-glosso, haud dubie lacertus alter ab lingua ad pharyngem, *Sant.*

Est le genio-pharyngien, *Win.*

Portio a petroso, an pharyngæi, *Doug.* pars quæ salpingo-pharyngeus?

Le petro-pharyngien, *Win.*

Coraco-brachialis

Carnosa pars interioris principii cubitum flectentium primi, *Ves.*

Carnosa pars alterius initii primi cubitum flectentis, *Col.*

Primi cubitum flectentis insignis musculosa portio, quam inter humeri motores jamdiu recenseo, *Arant.*

Coracoideus, sive coraco-brachieus, *Riol.*

Portio carnosa, quam Placentinus pro peculiari musculo habuit, perforatum appellans, *Cas.*

Coraco-brachialis, *Cowp.*

Coraco-brachial, *Win.*

Coraco-hyoideus

Est septimus et octavus propriorum ossis υ referenti, *Ves.*

Quartus hyoïdis, *Col.*

Quarti paris hyoidis, *Fal.*

Quarti paris, ossi hyoidi, ad linguæ motum destinatorum, *Arant.*

Quarti paris ossis hyoidis, *Cas.*

Coraco-hyoideus, *Riol. Cowp. Doug.*

Paris quarti, oblique deorsum trahentis, coraco-hyoidei appellati, *Spig.*

Coraco-hyoides, *Morg.*

Coraco, seu costo-hyoides, *Sant.*

L'omoplat-hyoidien, communément coraco-hyoïdien, *Win.*

Corrugator supercilii

Est qui sub cute supercilii, *Coiter.*

An pertinet ad supercilii musculum, *Fab.* ?

Notatus a Volchero Coiter, deprimendo, corrugando, et retrahendo versus nares supercilio destinatus, *Riol.*

Corrugator, *Cowp. Morg.*

Musculus frontalis verus, seu corrugator Coiteri, *Doug.*

Corrugator supercilii, *Sant.*

Le muscle sourcillier, *Win.*

Cremaster

Virilis testis musculus, *Ves.*

Musculus testiculi, *Col.*

Testis musculus, *Fal.*

Musculus testis, *Laur.*

Cremaster, *Riol. T. Barth. Spig. De Mar. De Graaf. Cowp. Doug. Sant.*

Le Cremaster, *Win.*

Crico-arytænoideus lateralis

— Propriorum laryngis septimus et octavus, *Ves.*

Alter musculus, nunc dicto contiguus, &c. Musculorum laryngis, qui ipsius proprii dicuntur, tertius, *Col.*

Ex propriis laryngis musculis, internorum, primi paris, *Fabric.* Unum par ab innominata, &c.

Quibus musculis opponuntur illi qui utrinque in angulo sunt, &c. Tertii paris laryngis propriorum, *Cas.*

Alterum vero eidem ossi, alarum instar, præpositum, &c. Extendentis ad latera, sive aperientis rimulam secundi paris. Crico-arytenoidei lateralis, *Spig.*

Crico-arytænoides lateralis, *Cowp.*

Crico-arytænoideus lateralis, *Doug.*

Le crico-arytenoïdien lateral, *Win.*

Crico-arytænoideus posticus

Propriorum laryngis quintus et sextus, *Ves.*

Musculorum laryngis, qui ipsius proprii dicuntur secundus, *Col.*

Ex propriis laryngis musculis posterior, ab infima innominatæ parte, &c. *Fabric.*

Huic oppositus est, qui extendit, &c. Secundi paris laryngis propriorum, *Cas.* Paris Cucullaris.

Crico-arytenoideus, *Riol.*

Extendentis recta, sive aperientis rimulam paris primi, crico-arytænoidei postici, *Spig.*

Crico-arytænoidius posticus, *Cowp.*
Paris crico-arytænoidæi posterioris, *Morg.*
Crico-arytænoidæus posticus, *Doug.*
Le crico-arytenoïdien posterieur, *Win.*

Crico-thyreoideus
De hoc, *Vesalius*, Quatuor itaque primam secundæ jungentium, &c.
Musculorum laryngis, qui ipsius proprii dicuntur, primus, *Col.*
Paris quod exortum a cricoide cartilagine in scutiformem inseritur, *Fal.*
Ex propriis laryngis musculis anterior exteriorque, *Fabric.*
Præter hos notantur in scutiformi, &c. Primi paris propriorum laryngis, *Cas.*
Crico-thyroideus anticus, *Riol.*
Alterius paris extendentium, crico-thyroidei antici dicti, *Spig.*
Paris crico-thyroidis, *Vesling. Verheyen.*
Paris crico-thyroidei, *De Mar.*
Crico-thyroideus, *Cowp. Doug.*
Crico-thyroides, *Sant.*
Le crico-thyroïdien, *Win.*

Cruralis
Pars octavi tibiam moventium, *Ves.*
Pars octavi tibiæ musculi, *Col.*
Crureus, *Sylv. Riol. Doug.*
Extendentium tibiam quarti, vasti interni, *Spig.*
Femoreus, *De Mar.*

Crureus, seu femoreus, *Cowp.*
Le crural, *Win.*

Cucullaris
Secundus scapulam moventium, *Ves.*
Cucullaris, *Col. Spig.*
Trapesius, *Riol.*
Cucullaris, et trapezius, *Cowp.*
Le trapeze, *Win.*

Curvator coccygis

D

Deltoïdes
Secundus brachium moventium, *Ves.*
Secundus humeri musculus, epomis, deltois, et humeralis, *Col.*
Secundus movens humerum, *Fal.*
Deltoides, *Riol. Steno. Lower. Cowp.*
Elevator, attollens humerum, δελτοειδης, deltiformis, *Spig.*
Deltoides, *Doug.* qui clarus atque peritissimus vir, etiam deltoïdem in portiones, quas dixi (ait Albinus) distinctum, nuper, cum in hanc regionem venisset, et de hac re coram inter nos forte conferremus, mihi exhibuit.
Le deltoïde, *Win.*

Depressor alæ nasi
Constrictor alæ nasi, ac depressor labii superioris, *Cowp.* 1694.

Depressor labii superioris proprius, *Doug.*

Constrictor alæ nasi, *Cowp.* 1724.

Musculus labri superioris arctandis naribus communis, *Sant.* et huc quoque pertinet myrtiformis, seu pinnarum dilatator proprius.

L'incisif mitoyen, *Win.*

Huic adjacentem (ait Albinus) vidimus *anomalum* quendam, qui aberrans ipsius pars esse videtur. Hic anomalus est rhomboidæus, *Sant.*—Ejus generis quoque est narium lateralis, *Ejusd.*

Depressor anguli oris

Hic a *Vesalio* haud dubie habitus pro parte latissimi colli, qui est alterius lateris primus musculus eorum qui buccas et labra movent.

Est a menti lateribus adscendens in labrum supernum, *Sylv.*

Labium superius deorsum movens, a mento in illud labium delatus, *Laur.*

Ex propriis, quo superius labrum deorsum movetur, *Riol.*

Quarti paris propriorum labiis, *Vesling.*

Depressor labiorum, *Cowp.*

Depressor labiorum communis, *Doug.*

Labrorum communis depressor, seu triangularis, *Sant.*

Le triangulaire, *Win.*

Depressor labii inferioris

Est unus ex quatuor musculorum labris pró-
priorum duobus inferioribus, *Ves.*

A quo labrum inferius deorsum movetur, *Riol.*

Tertii paris, deprimentis inferius labium, *Spig.*

Quinti paris propriorum labiis, *Vesling.*

Depressor labii inferioris, *Cowp.*

Depressor labii inferioris proprius, *Doug.*

Labri inferioris depressor proprius, *Sant.*

Pars ejus qui le quarré, *Win.*

Diaphragma

Septum transversum, *Ves. Col. Arant.*

Diaphragma, *Laur. Fabric. Riol. Spig. Highmore. Pecquet. De Mar. Steno. C. Barth. Verheyen. Cowp. Doug. Morg. Sant.*

Le diaphragme, *Senac. Win.*

E

Epicranius

Occipito-frontalis, *Doug.*

Partes ejus carneæ posteriores sunt, supercilium trahentes, *Col.*

Occipitii musculi, *Fal.*

Occipitales, *Riol. Cowp. Sant.*

Les muscles occipitaux, *Win.*

Pars carnea anterior, musculosa frontis cutem movens substantia, *Ves.*

Musculi frontis, *Col.*

Musculus frontis, *Fal.*

Musculi frontales, *Riol. Morg.*

Musculi cutis frontis, *Spig.*
Frontales, *Cowp. Sant.*
Les muscles frontaux, *Win.*
Pars per nasi dorsum excurrens, nasum dilatantes, adhuc a nemine cogniti, *Col.*
Quædam carnosæ fibræ a medio supercilio et spina narium exortæ, *Fal.*
Musculus nasi, *Cas.* aut pars ejus.
Pars elevatoris alæ nasi, *Cowp.*
Les pyramidaux, *Win.*
Huc pertinent proceri nasi, *Sant.*

Erector clitoridis

Est clitoridis musculus satis manifestus, *Fal.*
Clitoridis exilis musculus tensioni dicatus, *Laur.*
Superior rotundus, *Riol.*
Musculus qui ab osse coxendicis oritur, *De Graaf.*
Clitoridis musculus, *Verheyen.*
Erector clitoridis, *Cowp.*
The first (belonging to the clitoris), *Doug.*
L'ischio-caverneux, *Win.*

Erector penis

Tertius et quartus penis musculus, *Ves.*
Posterior penis musculus, *Col.*
Erector, *Riol.*
Collateralis, sive penem erigens, *Spig. High. De Graaf.*
Penis erector, *Verheyen.*
Erector penis, *Cowp. Doug.*

L'ischio-caverneux, *Win.*

Extensor brevis digitorum pedis

Decimus sextus pedis digitos moventium, *Ves.*

Postremus musculus pedis, *Col.*

Brevis digitûm tensor, sive pedieus, *Riol.*

Extendens digitorum secundum articulum, *Spig.*

Extensor pollicis brevis, una cum extensore digitorum brevi, *Cowp.*

Extensor brevis, *Cowp. Doug.* una cum extensore brevi.

Extensor digitorum brevis, *Morg.*

Le court extenseur commun des orteils, *Win.*

Extensor communis digitorum manus

Decimus septimus digitos moventium, *Ves.*

Primus manus externus musculus, *Col.* Vide *Laur.* in digitûm tensore.

Magnus extensor digitorum, *Riol.*

Digitorum extensor primus, *Spig.*

Extensor digitorum communis, seu digitorum tensor, *Cowp.*

Extensor digitorum communis, *Doug*

L'extenseur des quatres doigts, *Win.*

Extensor longus digitorum pedis

Decimus quartus pedis digitos moventium, *Ves.*

Secundus musculus anterioris pedis, *Col.*

Longus digitûmtensor, sive cnimodactyleus, *Riol.*

Digitorum tertium internodium extendens, *Spig.*
Extensor digitorum pedis longus, *Cowp.*
Extensor longus, *Doug.*
Le long extenseur commun des orteils, *Win.*

Extensor major pollicis manus
Vigesimus primus digitos moventium, *Ves.*
Quartus manus exterior musculus, *Col.*
Pollicis tertium os extendens, *Spig.*
Extensor tertii internodii ossis pollicis, *Cowp.*
Extensor tertii internodii, *Doug.*
Le second extenseur du pouce, *Win.*

Extensor minor pollicis manus
Vigesimi tertii digitos moventium portio, cujus tendo in secundi ossis pollicis radicem inseritur, *Ves.*
Quinti manus exterioris musculi, *Col.* pars quæ ad secundum pollicis articulum procedit.
Secundi et tertii pollicis internodii extensoris, *Spig.* portionis inferioris portio cujus tendo secundo et tertio pollicis ossi adnascitur.
Extensor secundi internodii ossis pollicis, *Cowp.*
Extensor secundi internodii, *Doug.*
Pars ejus qui le premier extenseur du pouce, *Win.* illa autem qui s'attache sur la partie convexe de la base de la seconde phalange.

Extensor proprius digiti auricularis
Decimus octavus digitos moventium, *Ves.*

Secundus manus exterior musculus, *Col.* Vide *Laur.* in digitûm tensore.
Extensor proprius auricularis digiti, *Riol.*
Extendentium secundus, *Spig.*
Vide extensorem digitorum manus, *De Mar.*
Extensor minimi digiti, *Cowp. Doug.*
L'extenseur propre du petit doigt, *Win.*

Extensor proprius pollicis pedis
Decimus quintus pedis digitos moventium, *Ves.*
Tertius musculus anterioris pedis, *Col.*
Extensor pollicis, *Riol.*
Pollicis tensor, *Spig.*
Extensor pollicis longus, *Cowp.*
Extensor longus, *Doug.*
Le grand extenseur du pouce du pied, *Win.*

Externus mallei
Musculus auris externus, *Barth.*
Le premier de ceux qui appartiennent au marteau, et l'externe, *Du Verney.*
Obliquus auris, *Cowp.*
Musculus processus minimi, *Valsalv.*
Obliquus auris, vel externus Du Verney, *Doug.*
Le muscle anterieur du marteau, *Win.*

F

Flexor brevis digiti minimi pedis
Vide musculos primos articulos flectentes, qui tertium musculum in numero succedunt, *Ves.*

Decem musculos singulis digitis pedis binos inservientes, *Col.*
Parvos musculos, quorum quatuor collocantur in planta, *Fal.*
Musculus minimum digitum extrorsum inflectens, *Cas.*
Interosseus, *Spig.*
Flexor primi ossis minimi digiti, *Cowp.*
Flexor primi internodii minimi digiti, *Doug.*
Flexor primi internodii minimi digiti proprius, *Cowp.* 1724.
Le petit parathenar, *Win.*

Flexor brevis digitorum pedis
Primus pedis digitos moventium, *Ves.*
Primus musculus pedis digitis inserviens, *Col.*
Brevis digitûmflexor, sive pedieus internus, vel pternodactyleus, *Riol.*
Flexor secundi internodii digitorum perforatus, *Spig.*
Perforatus, *Cowp.*
Perforatus, seu flexor sublimis, *Doug.*
Le court flechisseur commun des orteils, ou le perforé du pied, *Win.*

Flexor brevis pollicis manus
Est trium, qui secundo pollicis ossi famulantur, secundus una cum tertio, *Ves.* An eo etiam pertinet, illorum duorum, qui pollicis primo ossi famulantur, primi pars secundum pollicis contingens internodium, *Ejusd.*

Octavus extremæ manus musculus, *Col.* una cum parte musculi pollicem flectentis volam versus, *Ejusd.*

Tertius cum quarto, et quinto, et sexto, et nono, forte et octavo, *Fal.*

Haud dubie pars thenaris, cum parte hypothenaris pollicis, *Riol.*

Secundi internodii pollicis flexor secundus, cum tertio et quarto, *Spig.* quo et pars primi internodii flexoris primi, *Ejusd.* pertinere videntur.

Pars flexoris primi et secundi ossis pollicis, *Cowp.*

Flexor secundi internodii pollicis, *Doug.* an pars etiam est adductor (pollicis) ad indicem, antithenar, *Riol.* ibidem?

Pars ejus, qui le thenar, *Win.* huc quoque pertinet pars ejus, qui le mesothenar, *Ejusd.* ut videtur, l'antithenar, ou demi-interosseux du pouce.

Flexor brevis pollicis pedis

Vide Musculos primos articulos flectentes, qui tertium musculum in numero succedunt, *Ves.*

Decem musculos singulis digitis pedis binos inservientes, *Col.*

Parvos musculos, quorum quatuor collocantur in planta, *Fal.*

An adducens pollicem, ossi pedii maximo intus attensus, *Sylv.*?

Musculus flexioni pollicis consecratus, *Cas.*
Interosseus, *Spig.*
Flexor pollicis brevis, *Cowp.*
Flexor brevis, *Doug.*
Pars ejus, qui le thenar, *Win.* una cum parte ejus, qui l'antithenar, *Ejusd.*

Flexor longus digitorum pedis
Est secundus pedis digitos moventium, *Ves.*
Sextus tibiæ musculus, *Col.*
Longus digitûmflexor, sive perodactyleus, *Riol.*
Digitorum tertii internodii flexor perforans, *Spig.*
Perforans, *Cowp.*
Perforans, seu flexor profundus, *Doug.*
Le long flechisseur commun des orteils, ou le perforant du pied, *Win.* una cum eo qui l'accessoire du long flechisseur des orteils.
Le perforant, *Ejusd.* una cum eo, qui l'accessoire du perforant, *Ejusd.*

Flexor longus pollicis manus
Tertius digitos moventium, *Ves.*
Sextus manus interior musculus, *Col.*
Tertius musculus, pollici dicatus, *Arant.*
Musculus a quo flectitur pollex, *Riol.*
Tertii internodii pollicis flexor, *Spig.*
Flexor tertii internodii, seu longissimus pollicis, *Cowp.*
Flexor tertii internodii, *Doug.*
Le long flechisseur du pouce, *Win.*

Flexor longus pollicis pedis

Tertius pedis digitos moventium, *Ves.*

Septimus tibiæ musculus, *Col.*

Pollicis flexor, *Riol. Spig.*

Flexor pollicis longus, *Cowp.*

Flexor longus, *Doug.*

Le long flechisseur du pouce, *Win.*

Flexor parvus digiti minimi manus

An sexti extremæ manus musculus, *Col.* pars quæ exit a ligamento brachialis?

An pars hypothenaris parvi digiti, *Riol.*?

Pars abductoris minimi digiti, *Cowp.*

Abductor minimi digiti, hypothenar, *Riol. Doug.*

G

Gemellus.

Primus pedem moventium, cum secundo, *Ves.*

Primus pedis extremi musculus, cum secundo, *Col.*

Primus movens pedem, cum secundo, *Fal.*

Gemelli, gastrocnemii internus et externus, *Riol.*

Extendentium pedem primus, gasterocnemius externus, gemellus externus, *Spig.*

Gasterocnemius, *De Mar. Steno.*

Gasterocnemius externus, item gemellus, *Cowp.*

The two outermost heads extensoris tarsi suralis, vel extensoris magni, *Doug.*

Gastrocnemii, *Heister.*

Les jumeaux, *Win.*

Les grands jumeaux, ou gastrocnemiens, *Ejusd.*

Gemini

Carneæ portiones, decimo femur moventium musculo attensæ, *Ves.*

Marsupium carneum, *Col.*

Secundus et tertius quadrigeminus, *Riol.*

Carneum marsupium, *Spig.*

Marsupium, *Cowp.*

Gemini, *Doug.*

Les petits jumeaux, *Win.*

Genio-glossus

Nonus linguæ, *Ves.*

Tertius et quartus linguæ, *Col.*

Primi paris linguæ, *Fal.*

Quinti paris ossi hyoidi, ad linguæ motum destinatorum, *Arant.* pars ad linguam pertinens.

Primi paris musculorum linguæ, *Cas.*

Genio-glossus, *Riol.* Lib. V. Cap. 17. ubi vitiose impressum *basio-glossus.*

Secundi paris, extrahentis linguam, geneo-glossi, *Spig.*

Genio-glossus, *Cowp. Doug.*

Le genio-glosse, *Win.*

Fasciculus ad epiglottidem pertinens, hic vide *Ves.* Lib. II. Cap. 21. duos musculos laryngis operculi, *Col.* Vesalius binos alios musculos communes describit, &c.

Est unus musculus in epiglottide humana, *Fabric.* Vide *Cas. Riol.*

Geminus epiglottidis levator, *Morg.*
Hyo-epiglotteos, *Pauli* Proef. in Van Morne opus.
Ab utroque latere epiglottidis membranacei ligamenti plures fibræ, *Verheyen.*
Retractor epiglottidis, *Sant.*
Epiglottidis attollens, *Heist.*
Glosso-epiglottideus, *Ejusd.*
Vide les hyo-epiglottiques, *Win.*

Genio-hyoideus
Quinti paris hyoidis ossis, *Fal.*
Quinti paris ossi hyoidi, ad linguæ motum destinatorum, *Arant.* pars hyoidi inserta.
Genio-hyoideus, *Riol. Cowp. Doug.*
Le genio-hyoïdien, *Win.*

Gluteus magnus
Primus femur moventium, *Ves.*
Primus musculus femur movens, *Col.*
Primus omnium maximus, sui lateris clunem efformans, *Arant.*
Maximus et extimus gloutius, *Riol.*
Extendentium primus, glutæus major, *Spig.*
Glutæus major, *Cowp.*
Glutæus maximus, *Doug.*
Le grand fessier, *Win.*

Gluteus medius
Secundus femur moventium, *Ves.*
Secundus femoris musculus, *Col.*
Secundus et medius gloutius, *Riol.*
Extendentium secundus, glutæus medius, *Spig.*
Glutæus medius, *Cowp. Doug.*

Le moyen fessier, *Win.*

Gluteus minor

Tertius femur moventium, *Ves.*

Tertius femoris musculus, *Col.*

Tertius et intimus gloutius, *Riol.*

Extendentium tertius, glutæus minor, *Spig.*

Glutæus minor, *Cowp.*

Glutæus minimus, *Doug.*

Le petit fessier, *Win.*

Gracilis

Secundus tibiam moventium, *Ves.*

Secundus tibiæ musculus, *Col.*

Posticus gracilis, *Riol.*

Flectentium tibiam secundus, gracilis, *Spig.*

Gracilis, *Cowp. Doug.*

Le gresle interne, ou droit interne, *Win.*

H

Hyo-thyreoïdeus

Communium laryngis primus et secundus, *Ves.*

Secundus communium laryngis, *Col.*

Primi paris communium laryngis musculorum, *Fab.*

Secundi paris communium laryngis, *Cas.*

Hyothyroideus, *Riol. Cowp. Doug.*

Paris flectentis thyroidem, quod hyothyroides dicitur, *Spig.*

Paris hyothyreoidei, *De Mar.*

Hyothyroides, *Morg. Sant.*

Le thyrohyoïdien, ou hyo-thyroïdien, *Win.*

I

Iliacus internus

Septimus femur moventium, *Ves.*

Sextus femoris, *Col.*

Iliacus, *Riol.*

Iliacus internus, *Spig. Cowp. Doug.*

L'iliaque, *Win.*

Indicator

Decimus nonus digitos moventium, *Ves.*

Tertius manus exterior musculus, *Col.*

Indicatorius, *Arant.*

Indicator, *Riol.*

Indicem abducens, *Spig.*

Indicis abductor, *Vesling.*

Extensor indicis, seu indicator, *Cowp.*

Extensor secundi internodii indicis proprius, vulgo indicator, *Doug.*

L' extenseur propre de l'index, *Win.*

Infraspinatus

Septimus brachium moventium, *Ves.*

Sextus humeri musculus, *Col.*

Infraspinatus, *Riol. Cowp. Doug.*

Circumagentium secundus, superscapularis inferior, *Spig.*

Le sous-epineux, *Win.*

Intercostales externi

Externi intercostales, *Ves.* præter partes quæ inter verarum costarum cartilagines.

Exteriores, præter partes easdem, *Col.*

Intercostales exteriores, *Fal. Steno.*
Intercostales externi, *Arant. Riol. Spig. Cowp. Doug. Heist.*
Les intercostaux externes, *Win.*

Intercostales interni
Interni intercostales, una cum externorum partibus, quæ inter verarum costarum cartilagines, *Ves.*
Interiores, una cum iisdem partibus, *Col.*
Intercostales interiores, *Fal. Steno.*
Intercostales interni, *Arant. Riol. Spig. Cowp. Doug. Heist.*
Les intercostaux internes, *Win.*
Partes, quæ costam proximam præterlabuntur, sunt costarum depressores proprii, Cowp. *Doug.*
Intracostales, *Verheyen. Morg.*
Intercostalium internorum partes, *Cowp.*
Les sous-costaux, *Win.*

Interossei externi digitorum manus
Sunt tres illorum octo, qui quatuor subserviunt digitis, *Ves.*
Octo aliorum musculorum, &c. *Col.*
Illorum octo, qui inter ossa metacarpi continentur, *Fal.* Obs. Anat. in illis Musculis, qui in summa et extrema Manu continentur.
Interossei externi, *Riol.*
Interossei, *Spig.*
Interossei manus, *Cowp.*

The external interossei, *Doug.*

Les interosseux externes, *Win. Heist.*

Interossei externi digitorum pedis

Vide musculos primos articulos flectentes, qui tertium musculum in numero succedunt, *Ves.*

Decem musculos singulis digitis pedum binos inservientes, *Col.*

Parvi musculi, quorum quatuor collocantur inter media ossa pedii, *Fal.*

Interossei externi, *Riol.*

Interossei, *Spig. Doug.*

Interossei pedis, *Cowp.*

Les interosseux superieurs du pied, *Win.*

Interossei interni digitorum manus

Sunt quatuor illorum octo, qui quatuor subserviunt digitis, *Ves.*

Octo aliorum musculorum, *Col.*

Illorum octo, qui inter ossa metacarpi continentur, *Fal.* Obs. Anat. in illis Musculis, qui in summa et extrema Manu continentur.

Interossei interni, *Riol.* præter priorem indicis.

Interossei, *Spig.*

Interossei manus, *Cowp.* prior indicis est abductor indicis.

The internal interossei, *Doug.* prior indicis est extensor tertii internodii indicis.

Les interosseux internes, *Win.* præter priorem indicis.

Interossei interni digitorum pedis

Vide musculos primos articulos flectentes, qui tertium in numero succedunt, *Ves.*

Decem musculum singulis digitis pedis binos inservientes, *Col.*

Parvos musculos, quorum quatuor collocantur in planta, *Fal.*

Sunt interossei interni, *Riol.*

Interrossei, *Spig. Doug.*

Interrossei pedis, *Cowp.*

Les interosseux inferieurs du pied, *Win.*

Interspinales colli

Interspinales colli, *Cowp.*

Interspinales, *Cowp. Doug. Morg.*

Les petits epineux du col, *Win.*

Supernumerarii, a round, slender, and long muscle, *Cowp.*

Musculus superspinalis colli, *Ejusd.*

Interpinales dorsi

Les petits epineux du dos, *Win.*

Interspinales lumborum

Les epineux des lombes, *Win.*

Intertransversarii dorsi

Les petits transversaires du dos, *Win.*

Intertransversarii lumborum

Intertransversales, *Doug.*

Les transversaires des lombes, *Win.*

Intertransversarii posteriores colli

Hi, præter sextum, aut fortasse priores, aut partes utrorumque, sunt. The muscles

placed between the transverse processes of the other vertebræ of the neck, *Cowp.* Philosoph. Transact. 1699, Vol. XXI. No. 251.

Intertransversales, *Doug.*

Sunt partes posteriores intertransversalium; *Cowp.* Myot. ann. 1724.

Aut aliqui horum, aut posteriorum, aut partes utrorumque, sunt les petits transversaires du col, *Win.*

Intertransversàrii priores colli

An sextus est, secundam vertebram primæ anteriori in sede connectens, *Eustach.* de Motu Capitis?

Est the flexor of the first vertebra on the second, *Dupré*, Philos. Trans. ann. 1699. Vol. XXI. No. 251.

Flexor vertebræ primæ super secundam, *Dupré*, Act. Eruditor. ann. 1699. Septemb.

The muscle employed in shaking the head, *Cowp.* ibid. in Philos. Trans. et Act. Erud.

Musculus caput concutiens, *Doug.* ut videtur.

Unus intertransversalium, *Cowp.* Myot. ann. 1724.

Le second transversaire anterieur, *Win.*

Reliqui, aut posteriores, aut utrorumque partes, sunt, the muscles placed between the transverse processes of the other vertebræ of the neck, *Cowp.* Phil. Trans. ann. 1699. Vol. XXI. No. 251.

Musculi transversis processibus reliquarum vertebrarum cervicis interjecti, *Cowp.* Act. Erud. ann. 1699, Septemb.

Intertransversales, *Doug.*

Sunt partes priores intertransversalium, *Cowp.*

Aut horum aliqui, aut posteriorum, aut partes utrorumque, sunt les petits transversaires du col, *Win.*

L

Latissimus colli.

Est alterius lateris primus musculus, eorum qui buccas et labra movent, *Ves.*

Musculus latus in collo positus, *Col.*

Πλατυσμα μυωδες, *Fal.*

Quinti paris maxillæ, *Arant.*

Musculus auriculæ et utrique labro communis, *Cas.*

Musculus latus, *Riol.*

Detrahens quadratus, communis buccarum labiorumque, *Spig.*

Quadratus genæ, seu tetragonus, *Cowp.* 1694.

Quadratus genæ, vel latissimus colli, *Doug.*

Quadratus genæ, or quadratus colli, by some called tetragonus, and by Galen platysma myoides, *Cowp.* 1724.

Platisma-myodes, *Sant.*

Le peaucier, *Win.*

Pars ex mala nascens, est risorius novus, *Sant.*

H

Pars ad auriculam pertinens, est portio musculi cutanei supra parotidem ad aurem adscendentis, *Riol.*

Adducens ad anteriora, *Spig.*

Sunt fibræ carneæ a musculo quadrato colli ad partem auriculæ inferiorem delatæ, *Valsalv.*

The common, proceeding from the quadratus genæ, *Doug.*

Latissimus dorsi

Quartus brachium moventium, *Ves.*

Quartus humeri musculus, *Col.*

Quartus musculus movens humerum, *Fal.*

Latissimus, aniscalptor, aut dorsalis maximus, *Laur.*

Aniscalptor, anitersor, latissimus, *Riol. Spig.*

Latissimus dorsi, sive aniscalptor, *Cowp.*

Latissimus dorsi, *Doug. Morg.*

Le grand dorsal, *Win.*

Laxator tympani

Alter in superiori meatus auditorii regione consistens, *Cas.* Qui a me primum inventus est, ait Cas.

Novus musculus, *Fabric.*

Exterior, *Ejusd.*

Auris internæ externus, *Riol. Spig.*

Externus mallei, *Schelhamerus* de Auditu.

Externus auris, vel laxator externus, *Cowp.*

Musculus processus minoris mallei, *Valsalv.*

Externus auris Aquapendent. vel Jul. Casser. Placent. *Doug.*

Le muscle externe ou superieur du marteau, *Win.*

Levator anguli oris

An est pars alæ nasi musculi, præsentis capitis (de buccarum, labrorum, et nasi alarum musculis) in altero latere quinti, aut omnium noni et decimi, *Ves.?*

Ipse tamen *tertii* eorundem *paris*, qui sunt zigomatici majores, partem esse suspicatus est, in Examine Obs. Fallop. in nasi alas, labia, et buccas moventibus; *Num tertium vero meum*, &c.

Est de quo *Fal.* Dum tertium par descripsit, novum musculum prætermisit, &c.

De quo *Riol.* labrum inferius sursum trahitur a musculo, &c.

Secundus ad latera trahens, sive abducens, *Spig.*

Elevator labiorum, *Cowp.*

Elevator labiorum communis, *Doug.*

Elevator labrorum communis, seu caninus, *Sant.*

Le canin, *Win.*

Levator ani

Musculus sedem attollens, *Ves.*

Latus, *Col.*

Levator, *Laur. Spig. Vesling.*

Major levator ani, *Riol.*

Levator ani, *Cowp. Morg. Sant. Heist.*

Levator magnus seu internus, *Doug.* An etiam partes ejus in fæmina sunt musculi vaginæ, *Doug.* App. concerning the Muscles of the Clitoris?

Le releveur de l'anus, *Win.*

Pars tenuis, quæ ad eum accedit, est alter ac postremus sphincteris lacertus, *Sant.*

Levatores breviores costarum

An sunt intercostalium externorum initium primum a transversis vertebrarum processibus, *Spig.*?

Sunt levatores costarum, *Steno. Morg.*

Costarum levatores Stenonis, *Doug.* quo etiam pertinet the fourth scalenus.

Supracostales breves, *Verheyen.*

Intercostalium externorum partes, *Cowp.*

Les sur-costaux, *Win.*

Levatores longiores costarum

Supracostales longi, *Verheyen.*

Les sur-costaux, *Win.*

Levator labii superioris

Est pars alæ nasi musculi, præsentis capitis (de buccarum, labrorum, et nasi alarum musculis) in altero latere quinti, aut omnium noni et decimi, *Ves.*

Pars paris sexti (eorum, quibus narium pinnæ, labia, et totius faciei cutis moventur) ab ipso (Vesalio) quinto in loco numerati, *Fal.*

Ex propriis, qui superius labrum sursum trahit, *Riol.* 4

Pars primi nasi alas abducentis, *Spig.*
Elevator labii superioris, *Cowp.*
Pars elevatoris labii superioris proprii, *Doug.*
Elevator musculus proprius labri superioris, seu incisorius, *Sant.*
L'autre portion de l'incisif lateral, *Win.*

Levator labii superioris alæque nasi

Est pars alæ nasi musculi, præsentis capitis (de buccarum, labrorum, et nasi alarum musculis) in altero latere quinti, aut omnium noni et decimi, *Ves.*
Pars paris sexti (eorum, quibus narium pinnæ, labia, et totius faciei cutis moventur) ab ipso (Vesalio) quinto in loco numerati, *Fal.* Vide et *Columb.*
Musculus supercilii musculo junctus, superiori labro insertus, *Cas.*
Pars primi nasi alas abducentis, *Spig.*
Retractor alæ nasi et elevator labii superioris, *Cowp.* 1694.
The second of the common of the nose, *Doug.*
Pars elevatoris labii superioris proprii, *Ejusd.*
Dilatator alæ nasi et elevator labii superioris, *Cowp.* 1724.
Pyramidalis, cum pyramidalis vel socio vel parte, *Sant.*
La grande portion de l'incisif lateral, una cum illo, quem dicit, le muscle oblique ou lateral, *Ejusd.* ut videtur.

Levator menti

Est elevator labii inferioris, *Cowp.*

Elevator labii inferioris proprius, *Doug.*

Elevator labri inferioris, *Sant.*

L'incisif inferieur, *Win.*

Levator palati mollis

Est haud dubie secundi paris musculorum, qui faucibus dilatandis, aut constringendis inserviunt, *Fal.*

Quem ex Fallopio sphenopharyngei nomine descripsit, *Riol.*

Est pterystaphilinus internus, *Riol.*

Secundi paris dilatantis fauces, *Spig.*

Paris interni gargareonis, *Vesling.*

Paris pterygo-staphylini interni, *De Mar.*

Sphæno-palatinus, *Cowp.* 1694. *Morg.*

Paris salpingo-staphylini, *Valsalv.*

Columellæ musculus, in triangularem expansionem deorsum productus, *Morg.*

Salpingo-staphilinus, Valsalv. Pteri-staphilinus externus vulgo, *Doug.*

Sphænostaphilinus, *Drake, Cowp.* 1724.

Salpingo-staphylinus, seu salpingo-palatinus, *Sant.*

Paris spheno-staphylini, rectius salpingo-staphylini, *Heist.*

Le petro-salpingo-staphylin, ou salpingo-staphylin interne, *Win.*

Levator palpebræ superioris

Est palpebrarum secundus, oculum aperiens, *Col.*

Musculus parvus et tenuis, &c. palpebram attollens, *Fal.* De quo *Ves.* Is namque gracili admodum principio, &c. Exam. Obs. Fal. in Palpebram moventibus.

Qui superiori palpebræ aperiendæ destinatus est, *Arant.*

Rectus, *Fabric.*

Palpebræ superioris primus, *Cas.*

Superiorem palpebram attollens, *Riol.*

Apertor oculi, attollens palpebram superiorem, *Spig.*

Pyramidalis, *Molin.*

Aperiens palpebram rectus, *Cowp. Doug.*

Le releveur propre, *Win.*

Levator scapulæ

Tertius hominis scapulam moventium, *Ves.*

Tertius scapulæ musculus, *Col.*

Levatores proprii, *Laur.*

Levator, *Riol.*

Scapulum attollens, levator, patientiæ musculus, *Spig.*

Levator scapulæ, *Cowp. Morg.*

Elevator, seu musculus patientiæ, *Doug.*

Le releveur propre de l'omoplate, *Win.*

L'angulaire, dit communement releveur propre, *Ejusd.*

Lingualis

Lingualis, *Doug.*

An les fibres longitudinales, *Win.?*

Longissimus dorsi

Undecimus et duodecimus dorsum moventium, *Ves.*

Secundus musculus dorsi, *Col.*

Quinti paris dorsi musculorum, præter partem spinis vertebrarum thoracis insertam, *Fal.*

Semispinatus, *Riol.*

Dorsi longissimus, *Spig.*

Dorsi longissimus, præter partem quæ inserta spinis thoracis, *Cowp.*

Longissimus, *Doug.*

Longissimus dorsi, *Morg.*

Le long dorsal, *Win.*

Longus colli

Est alterius musculorum, quos fere sub stomacho latitantes veteres appellasse videntur, pars cervicis vertebrarum corporibus inserta, *Ves.*

Pars eadem primi et secundi dorsum moventium, *Ejusd.*

Primi cervicis musculi, *Col.* pars vertebrarum corporibus annexa.

Pars alterius lateris musculi stomacho subjectorum, *Eust.*

Longus, *Riol.*

Cervicem flectentium primi paris, sive longi, *Spig.*

Longus colli, *Cowp. Morg.*

Longus, *Doug.*
Le long du col, *Win.*

Lumbricales manus
Musculi quatuor digitos pollici adducentes, *Ves.*
Quatuor extremæ manus musculi, post primum, *Col.*
Quatuor, qui parvi admodum in vola hærent chordis secundi, *Fal.*
Lumbricales, *Riol. Cowp. Doug.*
Flectentes primum internodium, *Spig.*
Les muscles lombricaux, *Hunauld.*
Les muscles lumbricaux, *Win.*

Lumbricales pedis
Sunt 19, 20, 21, 22, pedis digitos moventium, *Ves.*
Quatuor musculi pedis digitis inservientes, *Col.*
Extremi quatuor musculi, quos inter motores digitorum pedis descripsit Vesalius, *Fal.*
Lumbricâles, *Riol. Cowp. Doug. Morg.*
Flexores quatuor primi internodii, lumbricales, *Spig.*
Les lumbricaux des orteils, *Win.*

M

Major helicis
Helicis musculus, *Sant.*

Masseter

Est inferiorem maxillam moventium alterius lateris secundus, seu masseter, *Ves.*

Masseterus et mansorius dictus, *Col.*

Massiter, *Fal.*

Tertius attollens maxillam masseter, *Riol.*

Tertii paris lateralis, *Spig.*

Masseter, *Cowp. Doug. Sant.*

Le masseter, *Win.*

Minor helicis

Fibræ musculares in plana helicis facie, *Sant.*

Multifidus spinæ

Pars ejus, quæ in lumbis, est decimus tertius, et decimus quartus dorsum moventium, *Ves.*

Tertius dorsi musculus, *Col.*

Quæ in dorso, est decimus quintus, et decimus sextus dorsum moventium, *Ves.*

Quartus dorsi musculus, *Col.*

Quæ in collo, est pars septimi et octavi dorsum moventium, *Ves.*

Quarti cervicis musculi, *Col.*

Pars tertii paris dorsi musculorum, *Fal.*

Quæ in lumbis et dorso, est quarti paris dorsi musculorum, *Fal.*

An sacer, *Riol.?*

Quæ in collo, pars spinati, *Riol. Spig.*

Transversalis colli, *Cowp.*

Transversalis, *Doug.*

Sunt les vertebraux internes du demi-epineux, ou transversaire epineux du col, *Win.*

Quæ in dorso, semispinati, *Spig.* pars, ut videtur.
Semispinatus, *Cowp.*
Transversales dorsi interiores, *Doug.*
Le demi-epineux, ou transversaire epineux du dos, aut fortasse ejus tantum partes internæ, *Win.*
Quæ in lumbis, paris sacri, *Spig.*
Sacer, *Cowp.*
Transversalis lumborum, vulgo sacer, *Doug.*
Le transversaire epineux des lombes, anciennement le sacré, *Win.*
Portiones distinctæ in cervice, sunt haud dubie intervertebrales, *Doug.*

Mylohyoideus
Secundi paris ossi υ referenti propriorum, *Ves.*
Secundi paris hyoidis ossis, *Fal.*
Secundi paris ossi hyoidi, ad linguæ motum destinatorum, *Arant.*
Primi paris ossis hyoidis, *Cas.*
Milohyoideus, *Riol.*
Primi paris, recta attollentis, geniohyoidei, *Spig.*
Mylohyoideus, *Fal. Doug. Morg. Cowp.*
Mylo-hyoides, *Sant.*
Le mylo-hyoïdien, *Win.*

N

Nasalis labii superioris

An ad elevatorem labii superioris proprium, relatus a *Cowpero?*

Est tertius fibrarum ordo, &c. *Sant.*

Cæteri non distinxerunt ab orbiculari oris.

O

Obliquus externus abdominis

Oblique descendens, *Ves. Fabric. De Mar. Verheyen. Morg.*

Obliquus descendens, *Col. Riol. Spig. Cowp. Doug.*

Obliquus externus, *Laur.*

Obliquus descendens, seu exterior, *Sant.*

L'oblique externe, *Win.*

Obliquus inferior capitis

Sexti paris caput moventium, *Ves.*

Quintus caput movens, *Col.*

Septimus capitis, *Fal.*

Parvus musculus a secundæ vertebræ spina in processum transversum primæ oblique infixus, *Eust.* de Motu Cap.

Obliquus major, *Riol.*

Paris obliqui inferioris, *Spig.*

Obliquus inferior, *Cowp. Doug.*

L'oblique inferieur, ou grand oblique, *Win.*

Obliquus inferior oculi

Vide *Ves*. Lib. II. cap. 11. Circumductionis Opifices.

Est quintus oculi, *Col.*

Sextus, *Fal.* Obs. an. in Musculis Oculorum, et Ves. Exam. in Oculos Moventibus.

Obliquus alter brevis, *Arant.*

Obliquus infernus, *Fabric.*

Sextus, *Cas.*

Inferior, seu minor obliquus, *Riol.*

Quintus, qui obliquus primus est, et volvens, sive circumagens, exterior nobis dictus, aut inferior, *Spig.*

Obliquus minor, *Molin.*

Obliquus inferior, *Cowp. Doug. Morg.*

L'oblique inferieur, *Win.*

Obliquus internus abdominis

Oblique adscendens, *Ves. De Mar. Verheyen.*

Obliquus ascendens, *Col. Fabric.* De Respir. *Riol. Spig. Cowp. Doug. Drake.*

Obliquus internus, *Laur. Riol.* Anim. in Laur. *Morg.*

Obliquus alter, seu interior, *Sant.*

L'oblique interne, *Win.*

Obliquus superior capitis

Quinti paris caput moventium, *Ves.*

Sextus caput movens, *Col.*

Sextus capitis, *Fal.*

Obliquus musculus, qui retro a transverso primæ vertebræ processu in caput inseritur, *Eust.*
Obliquus minor, *Riol.*
Paris obliqui superioris, *Spig.*
Obliquus superior, *Cowp. Doug.*
L'oblique superieur, ou petit oblique, *Win.*

Obliquus superior oculi
Vide *Ves.* Circumductionis Opifices.
Tertius palpebrarum, *Col.*
Duorum in gyrum flectentium prior, *Fal.*
Quintus, *Ejusd.* et Ves. Exam. in Oculos Moventibus.
Obliquus ille qui per trochleam ducitur, *Arant.*
Trochleæ musculus, *Fabric.*
Trochlearis, *Cas.*
Alter ex obliquis superior, seu major, *Riol.*
Sextus, obliquorum secundus, circumagens interior, aut superior, vel etiam major, *Spig.*
Obliquorum, qui major est, *Molin.*
Obliquus superior, or trochlearis, *Cowp.*
Obliquus superior, *Doug. Morg.*
L'oblique superieur, *Win.*
An gracillimus est rectus quintus, *Molin.* et musculus trochlearis, *Ejusd.*

Obturator externus
Nonus femur moventium, *Ves.*
Nonus femoris musculus, *Col.*
Duodecimus, *Arant.*
Externus obturator, *Riol.*

Circumagentium secundus, externus obturator, *Cowp. Doug.*
L'obturateur externe, *Win.*

Obturator internus

Decimus femur moventium, *Ves.*
Decimus femoris musculus, *Col.*
Obturator internus, *Riol. Morg.*
Circumagentium tertius, obturator internus, *Spig.*
Marsupialis, seu bursalis, *Cowp.*
Marsupialis, seu obturator internus, *Doug.*
L'obturateur interne, *Win.*

Opponens pollicis manus

Est illorum duorum, qui pollicis primo ossi famulantur, primus, aut pars ejus, una cum secundo, *Ves.*
Decimus, una cum undecimo, *Fal.*
An et hic pars thenaris, *Riol.*
Est primi internodii pollicis flexor secundus, cum primo, aut parte ejus, ut videtur, *Spig.*
Pars flexoris primi et secundi ossis pollicis, *Cowp.*
Flexor primi internodii pollicis, *Doug.*
Pars ejus qui le thenar, *Win.*

Orbicularis oris

Est moles carnea, musculosa tamen quæ utrumque labium format, *Fal.*—Vide quæ *Ves.* in Exam. Observ. Fal. in Nasi Alas, Labia, et Buccas moventibus, in fine.

Musculus orbicularis, *Riol.*
Quartum par, constringens, *Spig.*
Constrictor labiorum, *Cowp.* 1694.
Sphincter labiorum, *Doug.*
Orbicularis labiorum, *Cowp.* 1724. Vide Sant. Obs. Quo etiam pertinet corrugatoris, seu protrusoris, *Ejusd.* interior ordo.
Les demi-orbiculaires, *Win.*
Portiones accessoriæ inferiores sunt productores inferioris labri, *Sant.*
Les accessoires du demi-orbiculaire inferieur, *Win.*
Portiones accessoriæ superiores sunt labri superioris fibrarum secundus ordo, *Sant.*
Les sur-demi-orbiculaires, *Win.*

Orbicularis palpebrarum

Duo palpebrarum musculi, *Ves.*
Palpebrarum primus, orbicularis, *Col.*
Exterior, qui totum oculum ambit, *Fal.*
Orbicularis palpebrarum, *Fabric.* una cum supercilii musculo, *Ejusd.*
Orbicularis palpebræ musculus major, *Cas.* una cum minoribus palpebrarum muculis, *Ejusd.*
Orbicularis latus, cum ciliari, *Riol.*
Qui claudentes palpebras, sive semicirculares, *Spig.*
Sphincter, *Molin.*
Orbicularis palpebrarum, *Cowp. Doug.*
Orbicularis oculi, *Sant.*

Le muscle orbiculaire, *Win.*

Portio quæ se adjungit ad levatorem labii superioris, est perpetuus lacertulus ab imo orbiculari, *Sant.*

P

Palatopharyngeus

Aut hic, aut constrictor isthmi faucium, sunt les fibres demi-circulaires, &c. *Dionis*, Anat. VIII. Demonst. On voit a coté deux arcades qui font l'entrée des fentes nasales; elles sont faites de fibres demi-circulaires, &c.

Est paris pharyngostaphylini, *Valsalv.* et staphylinopharyngæi, *Ejusd.*

Musculus columellæ, in thyroidis lateralem oram infixus, *Morg.*

Thyreo-staphilinus, *Doug.*

Sunt fibræ carneæ, quæ oriuntur from the side of the uvula, *Drake.*

Est œsophagei, *Cowp.* pars springing from the uvula.

Thyro-palatinus cum hypero, seu palato-pharyngæo, *Sant.*

Le pharyngo-staphylin, una cum eo qui le thyro-staphylin, *Win.*

Le thyro-pharyngo-staphylin, quo etiam pertinet le peristaphyli-pharyngien, *Ejusd.*

Palmaris brevis

Est un' altro musculo, che distende questa tela, *Valverd.*

Primus extremæ manus musculus scriptoribus ignotus, *Col.*

Caro quædam, quæ musculorum effigiem habet, *Fal.*

Carpieus, vel palmaris brevis, *Riol.*

Caro quædam quadrata, *Spig.*

Palmaris brevis, *Cowp.*

Palmaris brevis Joan: Bapt. Cannan. vel caro quadrata, *Doug.*

Le palmaire cutané, *Win.*

Palmaris longus

Musculus, nervosa sua exilitate mediæ volæ, et internæ digitorum sedis cuti subnatus, *Ves.*

Primus musculus manus interior, *Col.*

Latescentis chordæ musculus, *Fal.*

Palmaris, *Riol. Spig. De Mar. Morg.*

Palmaris longus, *Cowp. Doug.*

Le cubital gresle, communément nommé long palmaire, *Win.*

Pectineus

Pars octavi femur moventium, *Ves.*

Septimus femoris musculus, *Col.* aut ejus pars.

Pectineus, *Riol. Cowp.*

Flectentium quartus, *Spig.*

Pectinalis, *Doug.*

Le pectiné, *Win.*

Pectoralis

Primus brachium moventium, *Ves.*

Primus humeri musculus, *Col.*
Pectoralis, *Riol. Spig. Verheyen. Cowp. Doug.*
Le grand pectoral, *Win.*

Peroneus brevis
Octavus pedem moventium, *Ves.*
Quintus anterioris pedis musculus, *Col.*
Peroneus anticus, *Riol.*
Flectentium pedem secundus, peronæus secundus semifibulæus, *Spig.*
Peroneus secundus, *Cowp.*
Peronæus secundus, seu anticus, *Doug.*
Le moyen peronier, communément dit peronier anterieur, *Win.*

Peroneus longus
Septimus pedem moventium, *Ves.*
Quartus anterioris pedis musculus, *Col.*
Peroneus posticus, *Riol.*
Oblique moventium pedem, secundus abducens, peronæus primus, fibulæus, *Spig.*
Peronæus primus, *Cowp.*
Peroneus primus, seu posticus, *Doug.*
Le long peronier, communément dit peronier posterieur, *Win.*

Peroneus tertius
Nonus pedem moventium, *Ves.*
Musculus pedis qui tertius decimus annumeratur, *Col.*
Pars exsensoris digitorum pedis longi, *Cowp.*
Vesalius's ninth muscle of the foot, *Doug.* in Extensore longo

Quintus tendo extensoris longi digitorum pedis, *Morg.*
Le petit peronier, *Win.*

Plantaris
Tertius pedem moventium, *Ves.*
Tertius tibiæ musculus, *Col.*
Plantaris, *Riol. Spig. Cowp. Morg.*
Extensor tarsi minor, vulgo plantaris, *Doug.*
Le jambier gresle, dit vulgairement plantaire, *Win.*

Popliteus
Musculus in poplite occultatus, *Ves.*
Decimus tibiæ musculus, *Col.*
Popliteus, *Riol. Cowp. Doug.*
Oblique movens tibiam, suppopliteus, *Spig.*
Le poplité, ou jarretier, *Win.*

Profundus
Secundus digitos moventium, *Ves.*
Quintus manus musculus interior, *Col.*
Secundus, *Arant.*
Profundus, *Riol.*
Flexor tertii digitorum internodii, *Spig.*
Perforans, *Cowp. Doug.*
Le profond, *Hunauld.*
Le perforant, communément le profond, *Win.*

Pronator quadratus
Primus radium peculiariter agentium, *Ves.*
Octavus manus interior musculus, *Col.*
Inferior pronator quadratus, *Riol.*

Pronatorum primus, sive quadratus, *Spig.*
Pronator radii quadratus, *Cowp.* 1694.
Pronator quadratus, *Doug.*
Pronator radii quadratus, or inferior quadratus, *Cowp.* 1724.
Le pronateur quarré, ou transverse, *Win.*

Pronator teres
Tertius radium peculiariter agentium, *Ves.*
Septimus manus interior musculus, *Col.*
Superior pronator rotundus, *Riol.*
Pronatorum secundus, sive teres, *Spig.*
Pronator radii teres, *Cowp.*
Pronator teres, *Doug.*
Le pronateur rond, ou l'oblique, *Win.*

Psoas magnus
Femur moventium sextus, *Ves.*
Quintus femoris, *Col.*
Lumbaris, sive psoas, *Riol.*
Lumbalis musculus, *Spig. Barth.*
Psoas magnus, seu lumbalis, *Cowp.*
Psoas magnus, *Doug. Morg.*
Le psoas, ou lombaire interne, *Win.*

Psoas parvus
Parvus psoas, *Riol. De Mar. Cowp. Doug. Morg.*
Le petit psoas, *Win.*

Pterygoideus externus
Novi paris musculorum, *Fal.*

Musculi temporalis illa pars, quæ ab externa sede processuum, quos vespertilionum alis comparamus, &c. *Ves.*

Quintum par exerendæ maxillæ Fallopio adscriptum, *Arant.*

Pterygoideus externus, *Riol. Cowp.*

Quarti paris, pterygoidei abducentis, *Spig.*

Paris pterygoidis, sive alaris externi, *Vesling.*

Pterigoidæus externus Fal. *Doug.*

Pterigoides exterior, *Sant.*

Le petit pterygoïdien, ou pterygoïdien externe, *Win.*

Pterygoideus internus

Tertius musculus qui in ore latitat, *Ves.*

Musculus in ore latitans, *Col.*

Latens in ore, *Fal.*

Pterygoideus internus, *Riol. Cowp. Doug.*

Quinti paris maxillam abducentis, *Spig.*

Paris pterygoidis, sive alaris interni, *Vesling.*

Pterigoides interior, *Sant.*

Le grand pterygoïdien, ou pterygoïdien interne, *Win.*

Pyramidalis

An musculus parvus qui procedit a fine musculi longitudinalis, *Massæ?*

Est superius principium recti abdominis, *Ves.*

Carneum, *Col.*

Musculus quidam totus carnosus, *Fal.*

Carneum operculum, *Arant.*

Pyramidalis, *Riol. Spig. De Mar. Cowp. Doug. Verheyen. Sant.*
Le pyramidal, *Win.*

Pyriformis
Quartus femur moventium, *Ves.*
Quartus femoris musculus, *Col.*
Primus et superior quadrigeminus, iliacus externus, *Riol.*
Circumagentium primus, iliacus externus, pyriformis, *Spig.*
Pyriformis, seu iliacus externus, *Cowp. Doug.*
Le pyriforme, ou pyramidal, *Win.*

Q

Quadratus femoris
An est pars quinti femur moventium, *Ves.?*
Pars octavi femoris musculi, *Col.?*
Est undecimus movens femur, *Fal.*
Undecimus, *Arant.*
Quartus quadrigeminus quadratus, *Riol.*
Circumagentium quartus, *Spig.*
Quadratus femoris, *Cowp. Doug.*
Le quarré, *Win.*

Quadratus lumborum
Nonus et decimus dorsum moventium, *Ves.*
Primus dorsi musculus, *Col.*
Sexti paris dorsi, *Fal.*
Quadratus, *Riol. Doug.*
Paris lumborum quadrati, *Spig.*

Quadratus lumborum, *Cowp.*

Le quarré des lombes, ou lombaire externe, *Win.*

R

Radialis externus longior et brevior

Longior, una cum breviore, quartus brachiale moventium, *Ves.*

Septimus manus exterior musculus, *Col.*

Longior est radieus externus, qui ab acumine osseo brachii enascitur, *Riol.*

Brevior est radieus externus, qui a condylo externo brachii oritur, *Ejusd.*

Longior, una cum breviore, est extendentium (carpum) exterior, *Spig.*

Longior est, the outermost muscle, *Cowp.* in Extensore Carpi radiali.

Extensor carpi radialis longus or superior, *Doug.*

Le radial externe premier, *Win.*

Brevior est, the other beginning, &c. *Cowp.*

Extensor carpi radialis brevis or inferior, *Doug.*

Le radial externe second, *Win.*

Radialis internus

Secundus brachiale moventium, *Ves.*

Tertius interior manus musculus, *Col.*

Radieus internus, *Riol.*

Flectentium (carpum) exterior, *Spig.*

Flexor carpi radialis, *Cowp. Doug.*
Le radial interne, *Win.*

Recti oculi

Attollens est tertius oculum movens, *Ves.*
Unus ex quatuor oblongis musculis, *Col.*
Unus ex quatuor qui rectis motibus præfecti, *Fal.*
Ex iis qui rectis famulantur motibus, *Arant.*
Rectus superior, *Fabric.*
Qui a physiognomicis superbus dicitur, *Cas.*
Attollens, sive superbus, *Riol.*
Primus attollens, *Spig.*
Superbus, *Molin.*
Elevator oculi, *Cowp.*
Elevator, *Doug.*
Le releveur, *Win.*

Abductor est secundus oculum movens, *Ves.*
Unus ex quatuor oblongis musculis, *Col.*
Unus ex quatuor qui rectis motibus præfecti, *Fal.*
Ex iis qui rectis famulantur motibus, *Arant.*
Rectus exterior, *Fabric.*
Quem indignatorium appellant, *Cas.*
Abducens, sive indignatorius, *Riol.*
Quartus abducens, *Spig.*
Iracundus, *Molin.*
Abductor oculi, *Cowp.*
Abductor, *Doug.*
L'abducteur, *Win.*

Depressor est quartus oculum movens, *Ves.*

Unus ex quatuor oblongis musculis, *Col.*
Unus ex quatuor qui rectis motibus præfecti, *Fal.*
Ex iis qui rectis famulantur motibus, *Arant.*
Rectus inferior, *Fabric.*
Qui humilis vocatur, *Cas.*
Deprimens, sive humilis, *Riol.*
Secundus, sive depressor, *Spig.*
Humilis, *Molin.*
Depressor oculi, *Cowp.*
Depressor, *Doug.*
Deprimens, *Morg.*
L'abaisseur, *Win.*

Adductor est primus oculum movens, *Ves.*
Unus ex quatuor oblongis musculis, *Col.*
Unus ex quatuor qui rectis motibus præfecti, *Fal.*
Ex iis qui rectis famulantur motibus, *Arant.*
Rectus interior, *Fabric.*
Qui barbaris bibitorius appellatur, *Cas.*
Adducens, sive bibitorius, *Riol.*
Tertius adducens, *Spig.*
Bibitorius, *Molin.*
Adductor oculi, *Cowp.*
Adductor, *Doug.*
L'adducteur, *Win.*

Rectus abdominis
Rectus, præter ejus principium superius, *Ves. Col. Arant.*

Rectus, *Fabric. Riol. Spig. De Mar. Verheyen. Cowp. Doug. Sant.*
Le droit, *Win.*

Rectus cruris
Nonus tibiam moventium, *Ves.*
Nonus tibiæ musculus, *Col.*
Rectus gracilis, *Riol.*
Extendentium tibiam secundus, rectus, *Spig.*
Rectus femoris, *Cowp.*
Rectus, *Doug.*
Le droit, ou grêle anterieur, *Win.* Le droit anterieur, ou gresle anterieur, *Ejusd.*

Rectus capitis internus major
Est alterius musculorum, quos fere sub stomacho latitantes veteres appellasse videntur, pars in os occipitis inserta, *Ves.*
Pars eadem primi, et secundi dorsum moventium, *Ejusd.*
Primi cervicis musculi pars occipitio annexa, *Col.*
Nonus musculus capitis, *Fal.*
Alterius lateris musculi stomacho subjectorum, portio in occipitis os inserta, *Eust.*
Qui cum mastoideo caput flectit, *Riol.*
Rectus internus major, *Cowp. Doug.*
Le droit anterieur long, *Win.* Le grand droit anterieur, *Ejusd.*

Rectus capitis internus minor
Musculus digitalis latitudinis, ab eminente quadam linea occipitis ossis principium sumens, *Eust.*

Rectus internus minor, *Cowp.*
Le rengorgeur oblique, *Dupré.*
Rectus internus minor Cowp. *Doug.*
Rectus anticus minor, *Morg.*
Le droit anterieur court, *Win.* Le petit droit anterieur, *Ejusd.*

Rectus capitis lateralis
Musculus admodum parvus, qui a processu transverso primæ vertebræ ortus, *Fal.*
Alter musculus prædictis brevior et angustior, *Eust.*
Musculus obliquus, qui ante a transverso primæ vertebræ processu in caput inseritur, *Ejusd.*
Rectus lateralis, *Cowp.*
Le rengorgeur droit, *Dupré.*
Rectus lateralis, *Fal. Doug. Morg.*
Le premier transversaire anterieur, *Win.*

Rectus capitis posticus major
Tertii paris caput moventium, *Ves.*
Tertius musculus caput movens, *Col.*
Major rectus, *Riol.*
Rectus major, *Spig. Cowp. Doug.*
Le grand droit, *Win.*

Rectus capitis posticus minor
Quarti paris caput moventium, *Ves.*
Quartus musculus caput movens, *Col.*
Rectus minor, *Riol. Spig. Cowp. Doug.*
Le petit droit, *Win.*

Retrahentes auriculæ

Auris musculus a mammillari processu proficiscens, *Col.*

Secundus auriculæ, *Fal.*

Secundus propriorum auriculæ, *Cas.*

Proprius auris externæ, *Riol.*

Le second de l'oreille, *Du Verney.*

Retrahens auriculam, *Cowp.*

Posteriores auriculæ, *Valsalv.*

Le posterieur Vieussen. *Win.*

Posteriores auriculæ, et postici, *Sant.*

Huc quoque pertinent postici corrugatores, seu occipitales minores, *Ejusd.*

Rhomboideus major

Est pars major quarti scapulam moventium, *Ves.*

Quarti scapulæ musculi, *Col.*

Rhomboidis, *Laur. Riol. Spig. Cowp.* 1694.

The inferior part of the rhomboides, *Doug. Cowp.* 1724.

La portion inferieure du rhomboide, *Win.*

Rhomboideus minor

Est pars quarti scapulam moventium, *Ves.*

Quarti scapulæ musculi, *Col.*

Rhomboidis, *Laur.*

Octavus omoplatæ, *Cabrolius.*

Rhomboidis portio superior prorsus secreta, *Riol.*

Pars rhomboidis, *Spig.*

Quidam musculus, nunquam alias a me visus, *Bidloo.*

The uppermost part of the rhomboides, *Doug. Cowp.*

La portion superieure du rhomboide, *Win.*

S

Sacrolumbalis

Quartus in altero latere hominis thoracem moventium, *Ves.*

Quintus thoracis musculus, *Col.*

Quartus thoracis musculus, *Fal.*

Sacrolumbus, *Laur. Riol. Spig. Steno. Verheyen. Morg.*

Alius præterea in dorso musculus, qui cum spinalibus musculis pertinacissime commiscetur, *Fabric.*

Sacrolumbus, una cum inferiore parte cervicalis descendentis, *Diemer.*

Sacrolumbalis, *Cowp. Doug.*

Le sacrolombaire, *Win.*

Salpingopharyngeus

Sunt carneæ fibræ, quæ oriuntur from the roots of the cartilage excavated for the meatus a palato ad aurem, *Drake.*

Est salpingo-pharyngeus, *Sant.*

An le spheno-salpingo-pharyngien, *Win.* ?

Sartorius

Primus tibiam moventium, *Ves.*

Primus tibiæ musculus, *Col.*

Longus, sive sutorius, *Riol.*

Flectentium tibiam primus, sartorius, fascialis, fascia, *Spig.*

Sartorius, *Cowp. Doug.*

Le couturier, *Win.*

Scalenus lateralis

Ubi conjunctus cum medio, est octavi thoracis musculi pars, quæ inseritur in secundam thoracis, *Fal.*

Videtur esse scalenus secundus, *Cowp.* aut pars ejus.

An scaleni pars, a secunda costa enata, *Morg.*?

La portion anterieure du second scalene, *Win.*

Scalenus medius

Est pars tertii et quarti dorsum moventium, *Ves.*

Pars secundi cervicis musculi, *Col.*

Octavus thoracis musculus, *Fal.*

Pars scaleni, *Riol.*

Pars paris triangularis, *Spig.*

Scalenus tertius, *Cowp.* 1694, ut videtur.

The second scalenus, *Doug.*

An pars ejus est scalenus tertius, *Cowp.* 1724.?

Est la portion ou branche posterieure du premier scalene, *Win.*

Scalenus minimus

Scalenus posticus

Nonus thoracis musculus, *Fal.*

The third scalenus, *Doug.*

An scaleni pars, a costa secunda enata, *Morg.?*
La portion posterieure du second scalene, *Win.*

Scalenus prior
Est pars tertii et quarti dorsum moventium. *Ves.*
Pars secundi cervicis musculi, *Col.*
Septimus thoracis, *Fal.*
Pars scaleni, *Riol.*
Pars paris triangularis, *Spig.*
Scalenus primus, *Cowp.*
The first scalenus, *Doug.*
La branche ou portion anterieure du premier scalene, *Win.*

Semimembranosus
Quintus tibiam moventium, *Ves.*
Quartus tibiæ musculus, *Col.*
Semimembranosus, *Riol. Steno. Cowp. Doug.*
Flectentium tibiam quartus, semimembraneus, *Spig.*
Le demi-membraneux, *Win.*

Semispinalis dorsi
Semispinalis, *Doug.*
An sunt les vertebraux externes du demi-epineux, ou transversaire epineux du dos, *Win.?*
Reliqui non distinxerunt vel a multifido, vel a spinali colli, aut accensuerunt partem utrique.

Semitendinosus
Tertius tibiam moventium, *Ves.*
Tertius tibiæ musculus, *Col.*

Seminervosus, *Riol. Steno. Doug.*
Flectentium tibiam tertius, seminervosus, *Spig.*
Seminervosus, seu semitendinosus, *Cowp.*
Le demi-nerveux, *Win.*

Serratus anticus
Musculus qui scapulam antrorsum agit, *Ves.*
Primus scapulam moventium, *Ejusd.*
Secundus scapulæ, *Col.*
Serratus minor, *Riol. Spig.*
Serratus anticus minor, *Vesling. Cowp. Doug. Verheyen.*
Le petit pectoral, *Win.*

Serratus magnus
Secundus in altero latere thoracem moventium, *Ves.*
Secundus thoracis musculus, *Col.*
Qui a Galeno passim musculus in simis scapularum situs appellatur, *Fabric.*
Serratus major, *Riol. Spig.*
Serratus major anticus, *Verheyen. Cowp. Doug. Morg.*
Le grand dentelé, *Win.*

Serratus posticus inferior
Quintus in altero latere thoracem hominis moventium, *Ves.*
Quartus thoracis musculus, *Col.*
Musculus ad infimam dorsi partem, una cum alio musculo exiguo prædicto superposito, *Fabric.*

Serratus posticus inferior, *Riol. Spig. Vesling. Verheyen. Cowp. Doug. Morg.*

Le dentelé posterieur inferieur, *Win.*

Serratus posticus superior

Tertius in altero latere thoracem hominis moventium, *Ves.*

Tertius thoracis musculus, *Col.*

Musculus ad supremam dorsi partem prope cervicem, *Fabric.*

Serratus posticus superior, *Riol. Spig. Vesling. Cowp. Doug. Verheyen. Morg.*

Le dentelé posterieur superieur, *Win.*

Soleus

Quartus pedem moventium, *Ves.*

Quartus tibiæ musculus, *Col.*

Soleus, *Riol.*

Extendentium pedem secundus, gasterocnemius internus, *Spig.*

Gasteronocnemius internus, *Cowp.*

The two innermost heads extensoris tarsi suralis, vel extensoris magni, *Doug.*

Le soleaire, *Win.*

Sphincter externus ani

Musculus orbiculatim intestino obductus, *Ves.*

Musculus orbicularis recti intestini, sphincter dictus, *Col.*

Sphincter primus et externus, carnosus, *Riol.*

Constrictor, *Spig.*

Sphincter ani, *Cowp. Sant.*

Sphincter externus, *Doug.*

Lès sphincters cutanés, *Win.*

Pars per perinæum procurrens, videtur esse levator ani sextus gracilis et acuminatus, *Riol.*

Est l'un des muscules dilatateurs de l'urethre, *Littre.*

Urethræ dilatator posticus, *Heist.* 1719.

Penis musculus triangularis, *Morg.*

Urethræ virilis, dilatator posticus, sive triangularis, *Heist.* 1727.

Sphincter internus ani

An est musculus cutaneus et circularis in extrema sedis ora collocatus, *Fal.*?

Sphincter cutaneus, *Laur.*

Sphincter cutaneus, ac superficialis, *Riol.*

Sphincter internus, *Doug.*

Le sphincter intestinal, ou orbiculaire, *Win.*

Spinalis cervicis

Est pars septimi et octavi dorsum moventium, *Ves.*

Quarti cervicis musculi, *Col.*

Tertii paris dorsi musculorum, *Fal.*

Spinati, *Riol. Spig.*

Spinalis colli, *Cowp.*

Spinalis, *Doug.*

Les vertebraux externes du demi-epineux, ou transversaire epineux du col, *Win.*

Spinalis dorsi

Quinti paris dorsi musculorum, pars implantata in spinas vertebrarum thoracis, *Fal.*

Semispinati, *Spig.* pars, ut videtur.

Dorsi longissimi pars, quæ inserta spinis thoracis, *Cowp.*

Le grand epineux du dos, *Win.*

Splenius capitis

Primi paris musculorum aut caput, aut primam vertebram moventium, *Ves.* pars quæ in occipitium finit.

Primi moventis caput, in occipitium implantata, *Fal.*

Pars ejus, qui a recentioribus anatomicis ante alios descriptus, *Eust.*

Splenii, *Riol.*

Triangularis, splenii, *Spig.*

Superior splenii, *Cowp.*

Splenii, inserta processui mammillari, *Doug.*

La portion superieure du splenius, ou mastoïdien posterieur, *Win.*

Splenius colli

Primi paris musculorum aut caput, aut primam vertebram moventium, *Ves.* pars quæ in transveros vertebrarum processus nexum molitur.

Pars primi caput moventis, *Col.*

Primi moventis caput, in processus transversos inserta, *Fal.*

Pars ejus, qui a recentioribus anatomicis ante alios descriptus, *Eust.*

Splenii, *Riol.*

Triangularis, splenii, *Spig.*

Inferior splenii, *Cowp.*

Splenii, inserta vertebris colli, *Doug. Morg.*

La portion inferieure du splenius, ou masto-ïdien posterieur, *Win.*

Stapedius

Anne est ligamentum peculiare, a quo stapes sustinetur, *Schelham?*

Est le muscle de l'étrier, *Du Ver. Win.*

Musculus stapidis, *Cowp.*

Stapedis musculus, *Valsalv.*

Stapidæus, vel musculus stapedis, Du Ver. *Doug.*

Le second muscle de l'oreille interne, que nous appellons petit, *Vieus.*

Sternohyoïdeus

Est ossi υ referenti propriorum alterius lateris primus, *Ves.*

Primus hyoidis, *Col.*

Primi paris hyoidis ossis, *Fal.*

Primi paris ossi hyoidi, ad linguæ motum destinatorum, *Arant.*

Secundi paris ossis hyoidis, *Cas.*

Sternohyoïdæus, *Riol. Cowp. Doug.*

Secundi paris, detrahentis, sternohyoidei, *Spig.*

Sternohyoides, *Morg. Sant. Heist.*

Le sterno-hyoïdien, ou sterno-cleido-hyo-ïdien, *Win.*

Sternomastoïdeus

Musculi a pectoris osse et clavicula in caput inserti, pars ex pectoris osse pronata, *Ves.*

Pars eadem septimi caput moventis, *Col.*

Eadem septimi paris, eorum qui caput movent, *Eust.*

Eadem mastoidei, seu mastoidæi *Riol. Spig. Cowp. Doug.*

Eadem ejus, qui le sterno-mastoïdien, ou mastoïdien exterieur, *Win.*

Sternothyreoïdeus

Communium laryngis musculorum tertius et quartus, *Ves.*

Primus communis laryngis, *Col.*

Secundi paris communium laryngis musculorum, *Fabric.*

Primi paris communium laryngis, *Cas.*

Bronchius, *Riol.*

Primi paris extendentium thyroidem, vulgo bronchii dicti, at nobis sternothyroidei, *Spig.*

Sternothyroideus, *Cowp. Doug.*

Sternothyroides, *Morg. Sant.*

Le sterno-thyroïdien, *Win.*

Stylo-glossus

Quintus et sextus linguæ musculorum, *Ves. Col.*

Tertii paris linguæ musculorum, *Fal.*

Tertii paris propriorum linguæ, *Arant.*

Secundi paris linguæ, *Cas.*

Styloglossus, *Riol. Cowp. Doug.*

Sexti paris, oblique trahentis, styloglossi, *Spig.*

Le styloglosse, *Win.*

Stylohyoïdeus

Tertii paris ossis υ referenti propriorum, *Ves.*

Tertius hyoidis, *Col.*

Tertii paris hyoidis ossis, *Fal. Cas.*

Tertii paris ossi hyoidi, ad linguæ motum destinatorum, *Arant.*

Styloceratoides, *Riol.*

Tertii paris, oblique sursum trahentis, sive styloceratohyoidei, *Spig.*

Paris stylohyoidei, *De Mar.*

Stylohyoideus, *Cowp. Doug.*

Stylohyoides major, *Sant.*

Le stylo-hyoïdien, *Win.*

Stylohyoïdeus alter

Stylo-chondrohyoidæus, vel stylohyoidæus alter, *Doug.*

An elegant small muscle, &c. *Drake.*

De quo *Cowper*, Besides this I have frequently found another muscle, &c. in stylohyoideo.

Stylo-hyoides novus, *Sant.*

Stylopharyngeus

Quarti paris linguæ, quod et faucibus adscribi potest, *Fal.*

Stylopharyngeus, *Riol. Cowp. Valsalv. Morg. Doug. Sant.*

Tertii paris faucium, stylopharyngei, *Spig.*

Le stylo-pharyngien, *Win.*

Subclavius

Primus in altero latere thoracem moventium, *Ves.*

Primus thoracis musculus, *Col. Fal.*

Qui sub clavicula occultatur, *Fabric.*

Subclavius, *Riol. Spig. Cowp. Doug.*

Le souclavier, *Win.*

Sublimis

Primus digitos moventium, *Ves.*

Quartus manus interior musculus, *Col.*

Primus musculus, *Arant.*

Sublimis, *Laur. Riol.*

Digitorum secundi internodii flexor, *Spig.*

Perforatus, *Cowp. Doug.*

Le sublime, *Hunauld.*

Le perforé, communément le sublime, *Win.*

Subscapularis

Sextus brachium moventium, *Ves.*

Septimus humeri musculus, *Col.*

Immersus, sive subscapularis, *Riol.*

Circumagentium tertius, subscapularis, *Spig.*

Subscapularis, *Cowp. Doug.*

Le sous-scapulaire, *Win.*

Supinator brevis

Quartus radium peculiariter agentium, *Ves.*

Nonus manus exterior musculus, *Col.*

Brevis supinator, *Riol.*

Supinatorum secundus, *Spig.*

Supinator radii brevis, *Cowp.*

Supinator brevis, *Doug.*
Le court, ou petit supinateur, *Win.*

Supinator longus
Quatuor radium peculiariter agentium secundus, *Ves.*
Octavus manus exterior musculus, longissimus nuncupatus, *Col.*
Longus supinator, *Riol.*
Supinatorum primus, sive longior, *Spig.*
Supinator radii longus, *Cowp.*
Supinator longus, *Doug.*
Le long ou grand supinateur, *Win.*

Supraspinatus
Quintus brachium moventium, *Ves.*
Quintus humeri musculus, *Col.*
Sûpraspinatus, *Riol.*
Circumagentium humerum primus, superscapularis superior, *Spig.*
Supraspinatus, *Cowp. Doug.*
Le sus-epineux, *Win.* Le sur-epineux, *Ejusd.*

T

Temporalis
Inferiorem maxillam moventium primus alterius lateris musculus, seu temporalis, *Ves.*
Temporalis, *Col. Fal. Arant. Riol. Spig. Cowp. Doug. Sant.*
Le crotaphite, *Win.*

Tensor tympani
Musculus ossiculi malleo comparati, *Eust.*

Musculus ab Eustachio observatus, *Arant.*
Musculus malleum ad incudem movens, *Fabric.*
Internus, *Ejusd. Spig.*
Auris internæ secundus, *Cas.*
Qui ab osse cuneiformi prognatus, *Ejusd.*
Alter internus, et in concha latitans, *Riol.*
Musculus internus auris, *Molin.*
Internus mallei, *Schelham.*
Le second de ceux qui apartiennent au marteau, et l'externe, *Du Ver.*
Internus auris, *Cowp.*
Musculus majoris processus, *Valsalv.*
Internus auris Eustach. *Doug.*
Le monogastrique, *Vieuss.*
Le muscle interne du marteau, *Win.*

Tensor vaginæ femoris
Est pars carnea sexti tibiam moventium, *Ves.*
Eadem sexti tibiæ musculi, *Col.*
Membranosi, *Riol. Cowp. Doug.*
Extendentium tibiam primi, membranosi, musculus lati tendinis, *Spig.*
Le muscle aponeurotique, ou muscle du fascia lata, *Win.*
Le muscle de la bande large, ou du fascia lata, *Ejusd.*

Teres major
Tertius brachium moventium, *Ves.*
Tertius humeri musculus, *Col.*
Rotundus major, *Riol.*

Deprimens humerum rotundus, *Spig.*
Teres major, *Cowp. Doug.*
Le grand rond, *Win.*

Teres minor
Octavus movens humerum, *Fal.* Vid. quæ respondit Ves. in Exam.
Rotundus minor, *Riol.*
Musculus peculiaris, a nemine adhuc annotatus, cujus inventionem Placentinus sibi tribuebat, *Cas.* apud Spig.
Teres minor, *Cowp. Doug.*
Le petit rond, *Win.*

Thyreoarytænoïdeus
Propriorum laryngis nonus et decimus, *Ves.*
Musculorum laryngis, qui ipsius proprii diçuntur, quartus, *Col.*
Ex propriis laryngis musculis, internorum secundi paris, *Fal.*
Ultimi musculi duo sunt, *Ejusd.*
Flexio constringit clauditque rimulam, *Ejusd.*
Quarti paris laryngis propriorum, *Cas.* duo a postica internæ scutiformis parte, &c.
Thyroarytænoideus, *Riol. Cowp. Morg. Doug.*
Paris thyroarytænoidei, *Spig.*
Thyro-arytænoides, *Sant.* una cum thyro-epiglottidæo majore.
Le thyroarytænoïdien, *Dodart.*
Le thyro-arytenoïdien, *Win.* una cum eo qui le thyro-epiglotique, *Ejusd.*

Tibialis anticus

Sextus pedem moventium, *Ves.*

Primus musculus anterioris pedis, *Col.*

Tibieús anticus, *Riol.*

Flectentium pedem primus, tibiæus anticus, catenæ musculus, *Spig.*

Tibialis anticus, *Cowp. Doug.*

Le jambier anterieur, *Win.*

Tibialis posicus

Quintus pedem moventium, *Ves.*

Quintus tibiæ musculus, *Col.*

Quintus movens pedem, *Fal.*

Tibieus posticus, *Riol.*

Oblique moventium pedem primus, adducens pedem, nauticus, tibiæus posticus, *Spig.*

Tibialis posticus, *Cowp. Doug. Heist.*

Le jambier posterieur, *Win.*

Trachelomastoïdeus

Secundi paris caput moventium musculus tertius, *Ves.*

Pars secundi musculi capitis, *Col.*

Tertius movens caput, *Fal.*

Eorum, qui (duos, a recentioribus anatomicis ante alios descriptos) sequuntur, portio, quæ externam sedem occupat, *Eust.*

Pars complexi, *Riol. Cowp.* 1694.

Tertius musculus trigemini, aut compositi, *Spig.*

Trcahclomastoidæus, seu capitis par tertium, *Fal. Doug. Cowp.* 1724.

Le petit complexus, ou mastoïdien lateral, *Win.*

Tragicus

Musculus tragi, *Valsalv. Sant.*

Transversalis cervicis

Quintus et sextus dorsum moventium, *Ves.*

Tertius cervicis musculus, *Col.*

Secundi paris dorsi musculorun principium prius, *Fal.*

Transversarius, *Riol.*

Transversalis, *Spig.*

Le grand tranversaire du col, *Win.*

Transversus abdominis

Transversus, *Ves. Fab. Riol. Spig. Morg. Sant.*

Transversalis, *Col. Cowp. Doug.*

Le transverse, *Win.*

Transversus auriculæ

Sunt fibræ transversæ in gibbo auriculæ, *Valsalv.*

Fibræ, quæ in convexa conchæ parte, *Sant.*

Transversus pedis

Est novus musculus. Julius Placentinus Patavinus, Chir. et Anat. insignis, primus de hoc ad nos scripsit, *Bauhin.*

Decimus tertius digitorum pedis, *Ejusd.*

Musculus transversus, *Riol.*

Transversalis, *Cas. Morg.*

Transversalis pedis, *Cowp.*

Transversalis pedis Jul. Cas Placent. *Doug.*

Le transversal des orteils, *Win.*

Transversus perinæi

An est alius musculus ad virgæ latus minimus, *Stephan.?*

Levator ani parvus, *Riol.?*

Transversus, *T. Barth.*

Transversalis penis, *Cowp. Heist.*

Le dilatateur, qui part de la partie interieure de la tuberosité, *Littre.*

Levator ani parvus, seu externus, Riol. *Doug.*

Penis musculus transversus, *Morg.*

Transversalis, *Sant.*

Transversalis urethræ, *Morg.*

An le transversale de l'urethre, et le transverse, *Win.*

In fœmina transversalis, *Sant.*

Transversalis perinæi alter

Urethræ elevator, sive ejaculator, *Sant.*

An le prostatique inferieur, *Win.?*

In fœmina est depressor urethræ, *Sant.*

Triangularis sterni

Sextus in altero latere thoracem hominis moventium, *Ves.*

Sextus thoracis, *Col. Fal.*

Qui internæ sterni sedi apponitur, *Fabric.*

Triangularis et pectoralis internus, *Riol.*

Triangularis, *Steno. De Mar. Cowp. Doug.*

Sternocostales, *Verheyen. Sant.*

Les sterno-costaux, communément le triangulaire du sternum, *Win.*

Triceps brachii

Longus est, cubitum extendentium primus, *Ves.*

Tertius cubiti, *Col.*
Longus, *Riol.*
Le grand anconé, *Win.*
Brevis est, tertius cubitum extendentium, *Ves.*
Brevis, *Riol.*
Os cubiti extendentium secundus, *Spig.*
L'anconé externe, *Win.*
Brachialis externus, carnosa pars, qua primus extendentium augetur, quem secundum constituere licet, *Ves.*
Brachieus externus Riol, *Cowp.*
Brachialis externus, *Doug.*
L'anconé interne, *Win.*
Brevis cum brachiali externo, quartus cubiti, *Col.*
Longus una cum brachiali externo, est os cubiti extendentium primus, *Spig.*
Longus una cum brevi, Gemellus, *Cowp.*
Biceps externus, *Doug.*
Triceps totus, triceps cubiti, extensor cubiti magnus, triplici principio natus, *Doug.*
Vide cubiti extensores, *Morg.*

V

Vastus externus
Septimus tibiam moventium, *Ves.*
Septimus tibiæ musculus, *Col.*
Vastus externus, *Riol. Cowp. Doug.*
Extendentium tibiam tertius, vastus externus, *Spig.*

Le vaste externe, *Win.*

Vastus internus

Pars octavi tibiam moventium, *Ves.*

Pars octavi tibiæ musculi, *Col.*

Vastus internus, *Riol. Cowp. Doug.*

Pars extendentium tibiam quarti, vasti interni, *Spig.*

Le vaste interne, *Win.*

U

Ulnaris externus

Tertius brachiale moventium, *Ves.*

Sextus manus exterior musculus, *Col.*

Cubiteus externus, *Riol.*

Extendentium (carpum) interior, *Spig.*

Extensor carpi ulnaris, *Cowp. Doug.*

Le cubital externe, *Win.*

Ulnaris internus

Primus brachiale moventium, *Ves.*

Secundus musculus interior manus, *Col.*

Cubiteus internus, *Riol.*

Flectentium (carpum) interior, *Spig.*

Flexor carpi ulnaris, *Cowp. Doug.*

Le cubital interne, *Win.*

Z

Zygomaticus major

Est unus ex quatuor musculorum labris propriorum duobus primis, *Ves.*

Zygomaticus, *Riol. Doug. Cowp.* 1724. *Morg.*

Primi paris, sive attollentis labium superius, *Spig.* haud dubie.

Zugomaticus, *Cowp.* 1694.

Zygomaticus major, *Sant.*

Le grand zygomatique, *Win.*

An fasciculi ejus sub pingui labii inferioris excurrentes, sunt corrugatoris, seu protrusoris, ordo exterior, *Sant.?*

Zygomaticus minor

Est the shortest fleshy slip, *Doug.* in elevatore labii superioris proprio.

De quo *Morg.* Sic ab osse jugali fasciculum fibrarum non contemnendum, &c.

Zygomaticus minor, *Sant.*

Le petit zygomatique, *Win.*

PART II.

CONTAINING

THE MUSCLES PECULIARLY BELONGING TO THE OSSEOUS STRUCTURE, ARRANGED ACCORDING TO THE SEVERAL BONES TO WHICH THEY ARE ATTACHED; WITH GENERAL OBSERVATIONS ON THE DIFFERENT PARTS CONSTITUTING A MUSCLE, AND GENERAL OBSERVATIONS ON MUSCULAR ACTION.

THE

MUSCLES

ARRANGED

ACCORDING TO THE BONES.

CHAPTER I.

THE following Table contains all the muscles connected with the skeleton by origin or insertion. In the middle column the bones are arranged in the usual order of demonstration; the series commencing with the bones of the cranium, and proceeding regularly through the bones of the face, the neck, and the trunk, to those of the atlantal and sacral extremities; the single bones, the pairs, and the classes, are each followed by the muscles attached to them. The names of the muscles are either in Roman or Italic characters: the Roman characters express the muscles which are connected with the bones by insertion; the Italic characters, the muscles which are connected by origin. When any of the muscles have other origins, they are to be found in the first column towards the left in Italic characters; when other insertions, in the

third column towards the right in Roman characters.

Upon a plan somewhat analogous, the celebrated Cowper arranged the muscles according to the bones in which they are inserted; and the accurate Winslow, according to the bones to which they are attached, without the distinction into origin and insertion, which he disliked*. That distinction, however, is preserved in the following Table; not indeed on account of its accuracy, but on account of its general expediency, which more than compensates for any of those erroneous conclusions that the young anatomist, when not sufficiently informed of the circumstances, may chance to draw from it.

As the tables of both Cowper and Winslow are defective in point of enumeration, and as they exhibit no more at a time than one-half of the muscular attachments, they present not to the eye the connection of bones through the medium of muscles, nor assist the physiologist in explaining their functions.

The use of this table to the anatomist scarcely requires any explanation. On a cursory glance it presents to his view a number of circumstances not easily remembered, and which, though always connected in nature, are not very

* See page 32.

often associated in the memory. It explains satisfactorily many of the sympathies that exist between the motions of distant parts connected by muscular attachments or functions: As, for instance, how pain, arising from a luxation of the humerus, should, upon motion, extend to the sternum, the back, and the loins; and how pain, arising from injuries of the loins, should be affected by motions of the humerus when any powerful or extensive operation of the Latissimus dorsi is required.

It may likewise be useful in suggesting hints about the modes of reducing bones after cases of luxation or fracture: about placing the parts in the most easy and natural position after reduction; about what motions should be avoided, what should be allowed, what should be left to the patient himself, and what should necessarily be checked by bandages, and how these bandages ought to be applied.

If the young anatomist should not readily perceive how this kind of knowledge is to be acquired from examining the Table, he will be assisted by the explanations that are afterwards given of the several motions; as this Table and these explanations are intended to reflect a mutual light upon one another.

OS FRONTALE.

Occipitale. Temporalia.	*Epicranius.*	Cutis. Orbiculares palpebrarum. Corrugatores superciliorum. Levatores labii sup. alarumque nasi.
	Orbicularis palpebrarum.	Cutis. Epicran. Corrug. supercil.
	Corrugatores superciliorum.	Epicranius.
Sphenoidale. Temporalia. Jugalia.	*Temporales.*	Maxilla basilaris.

OSSA PARIETALIA.

Frontale. Sphenoidale. Temporalia. Jugalia.	*Temporales.*	Maxilla basilaris.

OSSA TEMPORALIA.

Sternum. Claviculæ.	Sternomastoidei.	
Processus transversi cervicis.	Trachelomastoidei.	
Processus spinales cervicis.	Splenii capitis.	
Occipitale. Frontale.	*Epicranius.*	Cutis. Orbic. palp. Corrug. supercil. Levator labii sup. alarumque nasi.

	Orbiculares palpebrarum.	Cutis Epicranius. Corrug. supercil. Levat. lab. sup. alarumque nasi.
Frontale. Sphenoidea. Parietalia. Jugalia.	*Temporales.*	Maxilla basilaris.
Jugalia.	*Masseteres.*	Maxilla basilaris.
	Digastrici.	Maxilla basilaris. Os hyoides.
	Stylohyoidei.	Os hyoides.
	Styloglossi.	Glossa seu lingua.
	Stylopharyngei.	Pharynx.
	Levatores palati mollis.	Velum pendulum palati.
	Laxatores tympanorum.	Mallei.
	Tensores tympanorum.	Mallei.
	Stapedii.	Stapedes.
	Anteriores auricularum.	Auriculæ.
	Retrahentes auricularum.	Auriculæ.

	MALLEI.	
Temporalia.	Laxatores tympanorum.	
Tubæ Eustachii.	Tensores tympanorum.	
Sphenoidale.	Externi malleorum.	
	INCUDES.	
	Quibus musculi nulli.	
	ORBICULARIA.	
	Quibus musculi nulli.	
	STAPEDES.	
Temporalia.	Stapedii.	
	OS OCCIPITALE.	
Proc. spin. dorsi et cervicis.	Trapezii seu cucullares.	Scapulæ. Claviculæ.
Proc. spin. cervicis.	Splenii capitis.	

Processus transversi cervicis et dorsi.	Complexi.	
Proc. spin. atlantis.	Recti capitis postici minores.	
Proc. spin. vertebræ dentatæ.	Recti capitis postici majores.	
Processus transversi cervicis.	Recti capitis interni majores.	
Atlas.	Recti capitis interni minores.	
Proc. trans. atlantis.	Recti capitis laterales.	
Proc. spin. atlantis.	Obliqui capitis superiores.	
Frontale. Temporalia.	*Epicranius.*	Cutis. Orbic. palp. corrug. supercil-iorum.
	* *Hyopharyngei.*	Os hyoides.
	* *Syndesmo-pharyngei.*	Syndesmus ossis hyoidis.
	* *Cephalo-pharyngei.*	Pharynx.

* Vide constrictores pharyngis Albini.

OS SPHENOIDALE:

Ossa temporalia, parietalia, jugalia, frontale.	*Temporales.*	Maxilla basilaris.	
Maxilla coronalis.	*Pterygoidei externi.*	Maxilla basilaris.	
Ossa palatina.	*Pterygoidei interni.*	Maxilla basilaris.	
	Pterygo-pharyngei.	Pharynx.	
	Circumflexi palati.	Velum pendulum palati.	Uvula.
	Externi malleorum.	Mallei.	
	Levatores palpebrarum superiorum.	Palpebræ superiores.	
	Obliqui superiores oculorum.	Oculi.	
	Recti attollentes oculorum.	Oculi.	
	Recti abductores oculorum.	Oculi.	
	Recti adductores oculorum.	Oculi.	
	Recti depressores oculorum.	Oculi.	

OS ESTHMOIDALE.

Cui musculi nulli.

OSSA LACHRYMALIA.

Quibus musculi nulli.

OSSA JUGALIA.

Frontale. Parietalia. Sphenoidale. Temporalia.	*Temporales.*	Maxilla basilaris.
	Masseteres.	Maxilla basilaris.
	Zygomatici majores.	Orbicularis oris.
	Zygomatici minores	Orbicularis oris.

OSSA NASALIA.

Quibus musculi nulli.

MAXILLA CORONALIS.

	Compressores narium.	Cutis.
	Levatores labii superioris alarumque nasi.	Alæ nasi. Orbic. oris.
	Levatores angulorum oris.	Orbicularis oris.
	Depressores alarum nasi.	Alæ nasi. Labrum superius.
Maxilla basilaris.	*Buccinatores.*	Orbic. oris.
	Mylopharyngei.	Pharynx.
Sphenoidale.	*Pterygoidei externi.*	Maxilla basilaris.
	Obliqui inferiores oculorum.	Oculi.

Sphenoidale.		

OSSA PALATINA.

Pterygoidei interni	Maxilla basilaris.
Azygus uvulæ.	Uvula seu staphylé.

VOMER.

Cui musculi nulli.

OSS. SPONGIOS. BASILAR.

Quibus musculi nulli.

MAXILLA BASILARIS.

Parietalia. Temporalia. Jugalia. Frontale. Sphenoidale.	Temporales.	
Temporalia Jugalia.	Masseteres.	
Sphenoidale. Maxilla coronalis.	Pterygoidei externi.	
Sphenoidale. Palatina.	Pterygoidei interni.	
Tela cellulosa inter cutem et musculos deltoideos pectoralesque majores	Latissimi colli.	Depressores angulorum oris &c. Vid. Albin.
Temporalia.	Digastrici.	
	Mylohyoidei.	Hyoides.
	Geniohyoidei.	Hyoides.
Hyoides.	*Geniohyoglossi.*	Glossa seu lingua.
Maxilla coronalis.	*Buccinatores.*	Orbicularis oris.
	Depressores angulorum oris.	Orbicularis oris.
	Depressores labii inferioris.	Orbicularis oris.
	Levatores menti.	Adeps et cutis labii inferioris.
[illegible]	*Mylopharyngei.*	Pharynx.

DENTES.

Quibus musculi nulli.

OS HYOIDES *.

Ossa temporalia.	Digastrici.	Maxilla basilaris *.
Maxilla basilaris *.	Mylohyoidei.	
Ossa temporalia.	Stylohyoidei.	
Maxilla basilaris *.	Geniohyoidei.	
Cartilago thyroides.	Thyrohyoidei.	
Sternum.	Sternohyoidei.	
Scapulæ.	Omohyoidei.	
Occipitale.	Hyopharyngei.	
	Hyoglossi.	Glossa seu lingua.
Maxilla basilaris.	*Geniohyoglossi.*	Glossa seu lingua.

* Incertum sæpe quæ mobiliora.

COLUMNA VERTEBRALIS.

	VERTEBRÆ CERVICIS.	
Vertebræ dors. Proces. trans. cervicis.	Longi colli.	
Atlas.	*Recti capitis interni minores.*	Os occipitale.
	PROCESSUS SPINALES.	
Processus spinales cervicis.	Interspinales colli.	
Proc. trans. cervicis et dorsi.	Multifidi spinæ.	
Proces. trans. cervicis et dorsi.	Semispinales colli.	
Proces. trans. dorsi.	Semispinales dorsi.	Proc. spin. dorsi.
Proces. spinales dorsi.	*Trapezii.*	Os occipitale. Scapulæ. Claviculæ.
	Splenii capitis.	Ossa temporalia.
Proc. spin. vertebræ dentatæ.	*Recti capitis postici majores.*	Os occipitale.
Proc. spin. atlantis.	*Recti capitis postici minores.*	Os occipitale.
Proces. spinal. vertebræ dentatæ.	*Obliqui capitis inferiores.*	Processus transversi atlantis.
Processus spinales dorsi.	*Serrati postici superiores.*	Costæ.
	Rhomboidei minores.	Bases scapularum.

PROCESSUS TRANSVERSI.

Proces. trans. cervicis.	Intertransversarii colli priores.	
Proces. trans. cervicis.	Intertransversarii colli posteriores.	
Processus spinales dorsi.	Splenii colli.	
Proces. transversi dorsi.	Transversales cervicis.	
Costæ.	Cervicales descendentes.	
Proces. spinalis vertebræ dentatæ.	Obliqui capitis inferiores.	Proces. trans. atlantis.
Proces. trans. dorsi.	*Semispinales colli.*	Proc. spin. cervicis.
	Multifidi spinæ.	Proc. spin. cervicis.
Proces. trans. dorsi.	*Complexi.*	Os occipitale.
Proces. trans. dorsi.	*Trachelo-mastoidei.*	Ossa temporalia.
Proces. trans. atlantis.	*Obliqui capitis superiores.*	Os occipitale.
Proces. trans. cervicis.	*Recti capitis interni majores.*	Os occipitale.
Proc. trans. atlantis.	*Recti capitis laterales.*	Os occipitale.
	Scaleni.	Costæ.
Vertebræ dorsi.	*Longi colli.*	Vertebræ cervicis.
	Levatores scapularum.	Scapulæ.
	Levatores breviores duo costarum.	Costæ.

	VERTEBRÆ DORSI.	
Ilia.	Quadrati lumborum.	Proces. trans. lumborum. Vertebra ultima dorsi. Costæ ultimæ.
Proces. trans. ultimi. Vertebra ultima dorsi. Vertebræ et proces. trans. lumborum.	*Psoæ Magni.*	Femora.
	PROCESSUS SPINALES.	
Proces. spinales lumborum.	Spinales dorsi.	
Proces. trans. dorsi.	Semispinales dorsi.	Proc. spin. cervicis.
Proces. trans. dorsi et lumborum.	Multifidi spinæ.	
Proc. spin. cervicis.	*Trapezii.*	Scapulæ. Claviculæ. Os occipitale.
Proces spinales sacri lumborum. Cristæ iliorum. Costæ.	*Latissimi dorsi.*	Humeri.
Proces. spinales lumborum.	*Serrati postici inferiores.*	Costæ.
Proces. spinales cervicis.	*Serrati postici superiores.*	Costæ.
	Rhomboidei majores.	Bases scapularum.
	Splenii colli.	Proces. trans. colli.
Proces. trans. dorsi.	* *Biventres cervicis.*	Os occipitale.

* Vide Albini Hist. Musculorum.

PROCESSUS TRANSVERSI.

Cristæ iliorum. Proces. spinales et transversi sacri et lumborum.	Longissimi dorsi.	Costæ.
	Semispinales dorsi.	Proces. spinales dorsi et cervicis.
	Multifidi spinæ.	Proces. spinales dorsi et cervicis.
	Semispinales colli.	Proces. spinales cervicis.
Proces. trans. cervicis.	*Complexi.*	Os occipitale.
Proces. spinales dorsi et cervicis.	*Biventres cervicis.*	Os occipitale.
Proces. trans. cervicis.	*Trachelo-mastoidei.*	Ossa temporalia.
Proces. trans. dorsi.	*Transversales cervicis.*	Proces. trans. cervicis.

VERTEBRÆ LUMBORUM.

Costæ.	*Diaphragma.*	Tendo cordiformis.
Vertebra ult. Proces. trans. ultim. dorsi.	*Psoæ magni.*	Femora.
	Psoæ Parvi.	Pubes.

	PROCESSUS SPINALES.	
Sacrum. Proces. trans. lumborum.	Multifidi spinæ.	
Ilia. Proces. spinales sacri, lumborum, et dorsi. Costæ.	*Latissimi dorsi.*	Humeri.
Proces. spinales dorsi.	*Serrati postici inferiores.*	Costæ.
Ilia. Costæ. Proces. spinales sacri. Proces. spinales et transversi lumborum.	*Sacrolumbales cum accessoriis.*	Costæ.
Ilia. Proces. spin. sacri. Proces. spin. et trans. lumborum.	*Longissimi dorsi.*	Costæ et proces. trans. dorsi.
Proces. spin. sacri. Trans. lumborum. Ilia. Ligamentum Pouparti.	*Obliqui externi abdominis.*	Costæ. Linea alba.
	PROCESSUS TRANSVERSI.	
Ilia.	Quadrati lumborum.	Costæ ultimæ. Vertebra ultima dorsi.
Ilia. Proces. spin. sacri et lumborum.	*Longissimi dorsi.*	Costæ et proc. trans. dorsi.
Ilia. Costæ. Proces. spin. sacri et lumborum.	*Sacrolumbales cum accessoriis.*	Costæ.

Sacrum.	*Multifidi spinæ.*	Proces. spin. lumborum et dorsi.
Ilia. Sacrum. Proces. spin. lumborum. Ligamentum Pouparti.	*Obliqui interni abdominis.*	Linea alba. Costæ.
Ilia. Ligamenta Pouparti.	*Transversi abdominis.*	Linea alba. Costæ.

VERTEBRÆ SACRI.

Quibus musculi nulli.

PROCESSUS SPINALES.

Ilia. Costæ. Proces. spin. lumborum et dorsi.	*Latissimi dorsi.*	Humeri.
Ilia. Proces. spin. et trans. lumbosum. Ligamenta Pouparti.	*Obliqui interni abdominis.*	Costæ. Linea alba.
Ilia. Proces. spin. et trans. lumborum.	*Longissimi dorsi.*	Proces. trans. dorsi et costæ.
Ilia. Costæ. Proces. spin. et trans. lumborum.	*Sacrolumbales cum accessoriis.*	Costæ.
Ilia. Coccyx. Proces. trans. sacri.	*Glutei magni.*	Femora. Vaginæ femorum.
Ilia. Proces. trans. sacri.	*Multifidi spinæ.*	Proces. spin. lumborum.

Processus Transversi.

Ilia. Proces. spin. sacri. Coccyx. Ligamenta sacro-sciatica.	*Glutei magni.*	Femora. Vaginæ femorum.
Ilia. Proces. spin. sacri.	*Multifidi spinæ.*	Proces. spin. lumborum.
	Coccygei.	Coccyx.
	Curvatores coccygis.	Coccyx.
Ilia.	*Pyriformes.*	Femora.

COCCYX.

Ischia.	Coccygei.	Coccyx.
Sacrum.	Curvatores coccygis.	Coccyx.
Pubes. Ischia.	*Levator ani.*	Sphincter ani. Acceleratores urinæ. Transversales perinei.
Ilia. Sacrum. Ligamenta sacro-sciatica.	*Glutei magni.*	Femora. Vaginæ femorum.

COSTÆ.

Costæ.	Intercostales.	
Proces. trans. dorsi.	Levatores longiores costarum.	

Proces. trans. dorsi et colli.	Levatores breviores costarum.	
Sternum. Cartilago ensiformis.	Triangulares sterni.	
Proces. spin. dorsi et cervicis.	Serrati postici superiores.	
Proces. spin. dorsi et lumborum.	Serrati postici inferiores.	
Ilia. Sacrum. Proces. spin. et trans. lumborum.	Sacrolumbales.	
Ilia. Sacrum. Proces. spin. et trans. lumborum.	Longissimi dorsi.	Proces. trans. dorsi.
Ilia.	Quadrati lumborum.	Proces. trans. lumborum. Costæ ultimæ. Vertebra ultima.
Ilia. Pubes.	Obliqui externi abdominis.	Linea alba.
Ilia. Sacrum. Obliqui externi. Proces. spin. et trans. lumborum.	Obliqui interni abdominis.	Linea alba.
Proces. trans. cervicis.	Scaleni.	
Ilia. Obliqui externi. Proces. trans. lumborum.	*Transversi abdominis.*	Linea alba.
	Subclavii.	Claviculæ.
Claviculæ. Sternum.	*Pectorales majores.*	Humeri.
	Serrati antici.	Scapulæ.
	Serrati magni.	Scapulæ.
Ilia. Sacrum. Proces. spin. lumborum et dorsi.	*Latissimi dorsi.*	Humeri.
	Accessorii ad sacrolumbalem.	Sacrolumbales.
Vertebræ lumborum.	*Diaphragma.*	Tendo cordiformis.

CLAVICULÆ.

Costæ primæ.	Subclavii.	
Occipitale. Proces. spin. cervicis et dorsi.	Cucullares.	Scapulæ.
Sternum.	*Sternomastoidei.*	Ossa temporalia.
Sternum.	*Sternohyoidei.*	Os hyoides.
Costæ et sternum.	*Pectorales.*	Humeri.
Spinæ scapularum.	*Deltoidei.*	Humeri.

SCAPULÆ.

Occipitale. Proces. spin. cervicis et dorsi.	Cucullares.	Claviculæ.
Proces. spin. cervicis et dorsi.	Rhomboidei.	
Proces. trans. cervicis.	Levatores scapularum.	
Costæ.	Serrati antici.	
Costæ.	Serrati magni.	
	Coracohyoidei.	Hyoides.
	Supraspinati.	Humeri. Capsæ articulorum.

	Infraspinati.	Humeri.	Capsæ articulorum.
	Teretes majores.	Humeri.	
	Teretes minores.	Humeri.	Capsæ articulorum.
	Subscapulares.	Humeri.	Capsæ articulorum.
Claviculæ.	*Deltoidei.*	Humeri.	
	Coraco-brachiales.	Humeri.	
	Tricipitum brachiorum capita longa.	Ulnæ et humeri.	
	Bicipites brachiorum.	Radii et aponeuroses cubitorum.	

HUMERI.

Claviculæ. Scapulæ.	Deltoidei.	
Scapulæ.	Supraspinati.	Capsæ articulorum.
Scapulæ.	Infraspinati.	Capsæ articulorum.
Scapulæ.	Teretes majores.	
Scapulæ.	Teretes minores.	Capsæ articulorum.
Scapulæ.	Subscapulares.	Capsæ articulorum.
Scapulæ.	Coraco-brachiales.	
Claviculæ. Costæ. Sternum.	Pectorales.	
Scapulæ.	Tricipitum brachiorum capita longa.	Ulnæ.
Proces. spin. sacri, lumborum, dorsi. Ilia. Costæ.	Latissimi dorsi.	
	Tricipitum brachiorum capita brevia.	Ulnæ.
	Tricipitum brachiorum capita, nomine Brachiales externi.	Ulnæ.
	Anconei.	Ulnæ.
	Brachiales interni.	Ulnæ.
	Supinatores longi.	Radii.

	Radiales externi longiores.	Metacarp. indicum.
Ulnæ. Capsæ articulorum.	*Supinatores breves.*	Radii.
Condylis radialibus humerorum, capsis articulorum, vaginis cubitorum, et ulnis, sepimentis aponeuroticis interpo itis, connexi oriuntur.	*Radiales externi breviores.*	Metacarpi digitorum mediorum.
	Extensores communes digitorum.	Phalanges digitorum.
	Extensores proprii auricularium.	Phalanges digitorum auricularium.
	Ulnares externi.	Metacarpi digitorum auricularium.
Condylis ulnaribus humerorum, capsis articulorum, vaginis cubitorum, et ulnis, sepiment isaponeuroticis interpositis, connexi oriuntur.	*Palmares longi.*	Aponeuroses palmares. Ligamenta annularia.
	Radiales interni.	Metacarpi indicum. Trapezia.
	Ulnares interni.	Ossa pisiformia. Lig. annularia.
	Pronatores teretes.	Radii.
Radii, et origines communes palmarium long. &c.	*Sublimes.*	Phalanges mediæ digitorum.

ULNÆ.

Scapulæ. Humeri.	Tricipites longi.	Capsæ articulorum.
Humeri.	. . . . breves.	
Humeri.	. . . . brachiales externi.	
Humeri.	Brachiales interni.	Capsæ articulorum.
Condylis radialibus humerorum, capsis articulorum, vaginis cubitorum, et ulnis, sepimentis aponeuroticis interpositis, connexi oriuntur.	*Extensores communes digitorum.*	Phalanges digitales.
	Extensores proprii auricularium.	Phalanges digitorum auricularium.
	Ulnares externi.	Metacarpi digitorum auricularium.
	Radiales externi breviores.	Metacarpi digitorum mediorum.
Ulnæ.	*Indicatores.*	Phalanges indicum.
Condylis ulnaribus humerorum, capsis articulorum, vaginis cubitorum, et ulnis, sepimentis aponeuroticis interpositis, connexi oriuntur.	*Palmares longi.*	Aponeuroses palmares. Ligamenta annularia.
	Radiales interni.	Metacarpi indicum. Ossa trapezia.
	Ulnares interni.	Ossa pisiformia. Lig. annularia.
	Pronatores teretes.	Radii.
Radii, et origines communes palmarium long. &c.	*Sublimes.*	Phalanges digitales mediæ.
Ligamenta interossea.	*Profundi.*	Phalanges digitales distales.

Radii. Ligamenta interossea.	*Abductores longi pollicum, seu Extensores primi internodii.*	Metacarpi pollicum, interdum ossa trapezia, et abductores breves.
Radii. Ligamenta interossea.	*Extensores minores, seu secundi internodii.*	Phalanges proximales pollicum.
Ligamenta interossea.	*Extensores majores, seu tertii internodii.*	Phalanges distales pollicum.

RADII.

Scapulæ.	Bicipites.	Aponeuroses cubitorum.
Humeri.	Supinatores longi.	
Humeri. Ulnæ. Capsæ articulorum.	Supinatores breves.	
Una cum radialibus internis, &c. Vide Humeri et Ulnæ.	Pronatores teretes. Pronatores quadrati.	
Una cum extensoribus commun. digitorum. Vide Humeri et Ulnæ.	*Ulnares externi.*	Metacarpi digitorum minimorum.
Vide Humeri et Ulnæ.	*Extensores communes digitorum.*	Phalanges digitorum.
Ulnæ interdum.	*Flexores longi pollicum.*	Phalanges distales pollicum.
Una etiam cum radialibus internis, &c. Vide Humeri et Ulnæ.	*Sublimes.*	Phalanges mediæ digitorum.

	CARPI.	
	SCAPHOIDEA.	
	Quibus musculi nulli.	
	LUNARIA.	
	Quibus musculi nulli.	
	CUNEIFORMIA.	
	Quibus musculi nulli.	
	PISIFORMIA.	
	Ulnares interni.	Metacarpidigitorumannularium. Ligamenta annularia.
Ligamenta annularia.	*Abductores digitorum auricularium.*	Phalanges proximales.

TRAPEZIA.

Ulnæ. Radii. Ligamenta interossea.	*Abductores longi pollicum nonnunquam.*	Metacarpi pollicum.
Ossa magna et unciformia.	*Opponentes pollicum, seu Flexores metacarporum.*	Metacarpi pollicum.
Ligamenta carpi.	*Abductores breves pollicum.*	Phalanges proximales pollicum.
Metacarpi pollicum. Metacarpi indicum interdum.	*Abductores indicum.*	Phalanges proximales. Tendines Extensorum.

TRAPEZOIDEA.

Ossa magna, unciformia. Metacarpi digitorum indicum, mediorum, annularium.	*Flexores breves pollicum.*	Phalanges proximales, interventu ossium sesamoidûm.

UNCIFORMIA.

Condyli ulnares humerorum, &c. Vide Humeri et Ulnæ.	Ulnares interni.	Pisiformia. Metacarpi digit. auricularium.
Ossa magna. Trapezoidea. Metacarpi digitorum indicum, mediorum, annularium.	*Flexores breves pollicum.*	Phalanges proximal. interventu ossium sesamoidûm.
Ligamenta carpi.	*Adductores metacarpi digitorum auricularium.*	Metacarpi digitorum auricularium.
Ligamenta carpi.	*Flexores parvi digitorum auricularium.*	Phalanges proximales digitorum auricularium.

METACARPI.

PRIMI, SEU POLLICUM.

Ligament. annularia. Trapezia. Ossa magna et unciformia.	Opponentes pollicum.	
Ulnæ. Radii. igamenta interossea.	Abductores longi pollicum, seu Extensores primorum internodiorum.	
Trapezia. Nonnunquam metacarpi indicum.	*Abductores indicum.*	Phalanges proximales indicum.

	SECUNDI, SEU INDICUM.	
Humeri.	Radiales externi longiores.	
Humeri. Sed vide Humeri et Ulnæ.	Radiales interni.	
	Interrossei.	Phalanges proximales et tendines Extensorum communium.
	Vola-radiales indicum.	
	Vola-ulnares indicum.	
	Anconi-radiales digitorum mediorum.	
Trapezia. Trapezoidea. Ossa magna, unciformia. Metacarpi digitorum indicum, mediorum, et annularium.	*Flexores breves pollicum.*	
	TERTII, SEU DIGIT. MEDIORUM.	
	Radiales externi breviores.	
	Interossei.	
Metacarpi secundi, seu indicum.	*Anconi-radiales digitorum mediorum.*	Phalanges proximales et tendines Extensorum communium.
Metacarpi quarti, seu digitorum annularium.	*Anconi ulnares digitorum mediorum.*	
	Adductores pollicum.	Phalanges proximales pollicum, interventu ossium sesamoidûm.

	QUARTI, SEU DIGIT. ANNULAR.	
	Interossei.	
	Vola-radiales digitorum annularium.	Phalanges proximales et tendines Extensorum communium.
Metacarpi quinti, seu digitorum auricularium.	*Anconi-ulnares digitorum annularium.*	
	QUINTI, SEU DIGIT. AURICULAR.	
Vide Humeri et Ulnæ.	Ulnares externi.	
Ossa unciformia. Ligamenta annularia.	Adductores metacarp. digitorum auricularium.	
	Interossei.	
	*Vola-radiales**.	Phalanges proximales et tendines Extensorum communium.

* Anconi-ulnares desunt; eorum vices supplent abductores digit. auricular.

PHALANGES DIGITALES.

POLLICUM.

PHALANGES PROXIMALES.

Ulnæ. Ligamenta interossea.	Extensores minores pollicum, seu internodiorum secundorum.	
Ossa unciformia, trapezoidea, magna. Metacarpi digitorum indicum, mediorum, annularium.	Flexores breves pollicum.	Interventu ossium sesamoidûm.
Trapezia. Ligamenta annularia.	Abductores breves pollicum.	Interventu ossium sesamoidûm.
Metacarpi digitorum mediorum.	Adductores pollicum.	Interventu ossium sesamoidûm.

PHALANGES DISTALES.

Ulnæ. Ligamenta interossea.	Extensores majores pollicum.
Radii. Ligamenta interossea. Nonnunquam Ulnæ et Humeri.	Flexores longi pollicum.

PHALANGES DIGITORUM.

INDICUM.

MEDIORUM.

ANNULARIUM.

AURICULARIUM.

	PHALANGES OMNES.	
Condyli radiales humerorum, &c. Vide Humeri et Ulnæ.	Extensores communes.	
	PHALANGES PROXIMALES.	
Tendines Profundorum.	Lumbricales.	Tendines Extensorum communium.
Metacarpi.	Interossei.	Tendines Extensorum communium.
	PHALANGES MEDIÆ.	
Condyli ulnares humerorum, &c. Vide Humeri et Ulnæ.	Sublimes.	

	PHALANGES DISTALES.	
Ulna. Ligamenta interossea.	Profundi.	

MUSCULI PROPRII.

DIGITORUM AURICULARIUM.

Una cum Extensoribus communibus.	Extensores proprii digitorum auricularium.	
Unciformia. Ligamenta annularia.	Flexores parvi digitorum auricularium.	Phalanges proximales.
Pisiformia. Lig. annular.	Abductores dig. auricular.*	Phalanges proximales.

DIGITORUM INDICUM.

Ulnæ.	Indicatores.	Tendines Extensorum communium.
Trapezia. Metacarpi pollicum.	Abductores indicum.	Phalanges proximales.

* Anconi-ulnarium vices supplent. Vide Interossei supra.

ILIA.

Proces. spinal. sacri, lumborum, et dorsi. Costæ.	*Latissimi dorsi.*	Humeri.
Sacrum. Proces. spinales et transversi lumborum.	*Longissimi dorsi.*	Costæ. Proces. transversi dorsi.
Sacrum. Proces. spinales et transversi lumborum.	*Sacrolumbales.*	Costæ.
Pubes.	*Obliqui externi abdominis.*	Costæ. Linea alba.
Obliqui externi. Sacrum. Proces. spin. et trans. lumborum.	*Obliqui interni abdominis.*	Costæ. Linea alba.
Obliqui externi. Proces. transversi lumborum.	*Transversi abdominis.*	Costæ. Linea alba.
Ligamenta ilio-lumbaria.	*Quadrati lumborum.*	Proces. transversi lumborum. Costæ duodecimæ. Vertebra duodecima dorsi.
Aliquando sacrum.	*Iliaci interni.*	Femora.
Sacrum.	*Pyriformes, seu Iliaci externi.*	Femora.
Sacrum. Coccyx. Ligamenta sacro-sciatica.	*Glutei magni.*	Femora et vaginæ femorum.
	Glutei medii.	Femora.

	Glutei parvi.	Femora.
	Tensores vaginarum.	Femora. Rotulæ. Tibiæ.
	Sartorii.	Tibiæ.
	Recti crurum.	Tibiæ, interventu rotularum.
	PUBES.	
	Psoæ parvi.	Vertebra ultima dorsi. Prima lumborum.
	Recti abdominis.	Costæ.
	Pyramidales.	Recti. Linea alba.
	Pectinei.	Femora.
	Graciles.	Tibiæ.
	Adductores longi.	Femora.
	Adductores breves.	Femora.
Ischia.	*Adductores magni.*	Femora.
Ischia.	*Obturatores externi.*	Femora.
Ischia.	*Obturatores interni.*	Femora.

ISCHIA.

	Gemini.	Femora.
	Semitendinosi.	Tibiæ.
	Semimembranosi.	Tibiæ.
Femora.	*Bicipites crurum.*	Fibulæ.
Pubes.	*Adductores magni.*	Femora.
	Quadrati femorum.	Femora.
Pubes.	*Obturatores externi.*	Femora.
Pubes.	*Obturatores interni.*	Femora.

FEMORA.

Ilia. Sacrum. Coccyx.	Glutei magni.	Vaginæ femorum. Rotulæ et tibiæ, interventu vaginarum.
Ilia.	Glutei medii.	
Ilia.	Glutei parvi.	
Ilia. Sacrum.	Pyriformes, seu Iliaci externi.	
Ischia.	Gemini.	

Ischia. Pubes.	Obturatores externi.	
Ischia. Pubes.	Obturatores interni.	
Ischia.	Quadrati femorum.	
Ilia.	Tensores vaginarum.	Rotulæ. Tibiæ.
Pubes.	Pectinei.	
Pubes.	Adductores longi.	
Pubes.	Adductores breves.	
Pubes. Ischia.	Adductores magni.	
Vertebræ et proces. transversi lumborum. Vertebræ et proces. transversi ultimi dorsi.	Psoæ magni.	
Ilium. Aliquando sacrum.	Iliaci interni.	
	Vasti externi.	Tibiæ, interventu rotularum.
	Vasti interni.	Tibiæ, interventu rotularum.
	Crurei.	Tibiæ, interventu rotularum.
	Gemelli.	Calcanea.
Capsæ genuum.	*Plantares.*	Calcanea.
	Capita brevia bicipitum crurum.	Fibulæ.
Capsæ genuum. Cartilagines semilunares.	*Poplitei.*	Tibiæ.

TIBIÆ.

Ilia.	Sartorii.	
Pubes.	Graciles.	
Ischia.	Semitendinosi.	
Ischia.	Semimembranosi.	
Ilia.	Recti crurum.	Interventu Rotularum.
Femora.	Crurei.	Interventu Rotularum.
Femora.	Vasti interni.	Interventu Rotularum.
Femora.	Vasti externi.	Interventu Rotularum.
Ilia.	Tensores vaginarum femorum.	Femora. Rotulæ.
Ligamenta interossea.	*Tibiales antici.*	Os cuneiforme internum. Metatarsi digitorum magnorum, primorum, seu pollicum.
Fibulæ.	*Extensores longi digitorum pedum.*	Phalanges digitorum minorum.
Fibulæ.	*Solei.*	Calcanea.
Fibulæ. Ligamenta interossea.	*Flexores longi digitorum pedum, seu profundi.*	Phalanges distales digitorum minorum.

Fibulæ. Ligamenta interossea.	Tibiales postici.	Ossa navicularia, unciformia, interna, media, externa, cuboidea, calcanea. Metatarsi digitorum tertiorum.

FIBULÆ.

Ischia. Femora.	Bicipites Flexores crurum.	
Tibiæ. Vaginæ femorum. Tendines bicipitum.	*Peronei longi.*	Metatarsi digitorum primorum, seu pollicum. Ossa cuneiformia prima.
	Peronei breves.	Metatarsi digitorum quintorum.
	Peronei tertii, seu Noni Vesalii.	Metatarsi digitorum quintorum.
Tibiæ.	*Extensores longi digitorum pedum.*	Phalanges digitorum minorum.
	Extensores proprii pollicum pedum.	Phalanges digitorum primorum.
Tibiæ.	*Flexores longi pollicum pedum.*	Phalanges distales digitorum primorum, seu pollicum. Calcanea.

TARSI.

Ossa Calcanea.

Femora.	Gemelli.	
Tibiæ. Fibulæ.	Solei.	
Femora. Capsæ genuum. Cartilagines semilunares.	Plantares.	
	Extensores breves digitorum pedum.	Tendines Extensorum longorum, tendinibus digitorum quintorum exceptis.
	Flexores breves digitorum pedum, seu sublimes.	Phalanges mediæ digitorum minorum.
	Massæ carneæ Jacobi Sylvii, seu Flexores digitorum accessorii.	Tendines Flexorum longorum digitorum pedum.
Ossa cuneiformia tertia. Nonnunquam adhesiones aliæ.	*Flexores breves pollicum pedum.*	Phalanges proximales, interventu ossium sesamoidûm.
Ligamenta astragalorum cervicis sustinentia.	*Abductores pollicum pedum.*	Phalanges proximales, interventu ossium sesamoidûm.

Ossa cuboidea, cuneiformia tertia. Nonnunquam metatarsi quarti, tertii, secundi. Tendines Peroneorum longorum.	*Adductores pollicum.*	Phalanges ptoximales, interventu ossium sesamoidûm.
Metatarsi digitorum minim. Aponeuroses plantares.	*Abductores minimorum digitorum.*	Phalanges proximales digitorum quintorum, seu minimotum.
	ASTRAGALI.	
	Quibus musculi nulli.	
	NAVICULARIA.	
Fibulæ. Ligamenta interossea.	Tibiales postici.	Ossa cuneiformia. Sæpe cuboidea. Calcanea. Metatarsi tertiorum digitorum.

CUBOIDEA.

Fibulæ. Ligamenta interossea.	Tibiales postici.	Navicularia. Cuneiformia. Sæpe Calcanea et metatarsi digitorum tertiorum.
Cuboidea. Cuneiformia tertia. Nonnunquam metatarsi quarti, tertii, secundi. Ligamenta trochlearia Peroneorum longorum.	*Adductores pollicum.*	Phalanges proximales, interventu ossium sesamoidûm.
Ligamenta trochlearia Peroneorum longorum. Metatarsi digitorum minimorum. Nonnunquam aponeuroses plantares.	*Flexores breves digitorum minimorum.*	Phalanges proximales digitorum quintorum, seu minimorum.

CUNEIFORMIA PRIMA, SEU INTERNA.

Tibiæ. Ligamenta interossea.	Tibiales antici.	Metatarsi digitorum primorum, seu magnorum, seu pollicum.
Tibiæ. Fibulæ. Vaginæ femorum. Tendines bicipitum.	Peronei longi.	Metatarsi digitorum primorum, seu magnorum, seu pollicum.

Tibiæ. Fibulæ. Ligamenta interossea.	Tibiales postici.	Ossa navicularia, cuneiformia secunda, tertia, Cuboidea. Calcanea. Metatarsi digitorum tertiorum.
Metatarsi primi et secundi.	*Abductores indicum; seu digitorum secundorum.*	Latera tibialia. Phalang. proximales.

CUNEIFORMIA SECUNDA, SEU MEDIA.

Tibiæ. Fibulæ. Ligamenta interossea.	Tibiales postici.	Ossa navicularia, Cuneiformia prima, tertia, Cuboidea, Calcanea. Metatarsi tertii.

CUNEIFORMIA TERTIA, SEU EXTERNA.

Nonnunquam tendines tibialium posticorum. Aponeuroses plantares. Cuboidea. Ligamenta inter cuboidea et cuneiformia tertia. Ligamenta inter cuboidea et calcanea.	*Flexores breves pollicum.*	Phalanges proximales, interventu ossium sesamoidûm.
Calcanea. Ligamenta Astragalorum cervices sustinentia.	*Abductores pollicum.*	Phalanges proximales, interventu ossium sesamoidûm.

METATARSI.

PRIMI, SEU POLLICUM.

	Transversales pedum.	Metatarsi quinti, &c. &c. ‡
Tibiæ. Fibulæ. Vaginæ femorum. Tendines bicipitum.	Peronei longi.	Ossa cuneiformia prima.
Metatarsi secundi. Ossa cuneiformia prima, seu interna.	† * *Abductores indicum, seu digitorum secundorum pedum.*	Latera tibialia. Phalang. proximales.

‡ Vide Pag. 211.

	SECUNDI, SEU INDICUM.	
		Phalang. prox. Tend. Extensorum.
Metatarsi primi. Ossa cuneiformia prima, seu interna.	† * *Abductores digitorum secundorum.*	Latera tibialia.
Metatarsi tertii.	† * *Adductores digitorum secundorum.*	Latera fibularia.
	TERTII, SEU DIGITORUM MEDIORUM.	
		Phalang. prox. Tend. Extensorum.
	* *Abductores digitorum tertiorum.*	Latera tibialia.
Metatarsi quarti.	† * *Adductores digitorum tertiorum.*	Latera fibularia.
	QUARTI, SEU TERTII, *Innes.*	
		Phalang. prox. Tend. Extensorum.
	* *Abductores digitorum quartorum.*	Latera tibialia.
Metatarsi quinti.	† * *Adductores digitorum quartorum.*	Latera fibularia.

* Hi sunt musculi interossei pedum. † Notat antiplantares et bicipites. Ceteri sunt plantares, quorum singuli singulis capitibus iuntur. Omnes, quoad latera phalangum quibus inseruntur, aut tibiales, aut fibulares sunt.

	QUINTI, SEU MINIMORUM DIGITORUM.	
Fibulæ.	Peronei tertii, seu Noni Vesalii.	
	Transversales pedum.	Metatarsi primi et quinti. Ossa sesamoidea fibularia. Digitorum primorum adductores. Interdum aliæ origines.
Ligamenta trochlearia Peroneorum longorum. Ossa cuboidea	*Flexores breves digitorum minimorum.*	Phalanges proximales digit. quint.
Calcanea. Aponeuroses plantares.	* *Abductores digitorum minimorum.*	Phalang. prox. Tend. Extensorum. Latera fibularia.
	* *Adductores digitorum minimorum.*	Latera tibialia.
	PHALANGES DIGITORUM.	
	PHALANGES PROXIMALES POLLICUM.	
Fibulæ.	Extensores proprii pollicum.	Phalanges distales.

Calcanea. Cuboidea. Ossa cuneiformia tertia. Nonnunquam adhesiones aliæ.	Flexores breves pollicum	Phalanges proximales, interventu ossium sesamoidûm.
Calcanea. Ligamenta astragalorum cervices sustinentia.	Abductores pollicum.	
Calcanea. Cuboidea. Cuneiformia tertia. Nonnunquam metatarsi quarti, tertii, secundi. Ligamenta trochlearia Peroneorum longorum.	Adductores pollicum.	
Calcanea.	Extensores breves digitorum.	Tendines Extensorum propriorum pollicum. Tendines Extensorum longorum. Tendinibus minimorum digitorum exceptis.

PHALANGES DISTALES POLLICUM.

Fibulæ.	Extensores proprii pollicum.	Phalanges proximales.
Fibulæ.	Flexores longi pollicum.	

	PHALANGES DIGITORUM MINORUM.	
	PHALANGES OMNES.	
Tibiæ. Fibulæ.	Extensores communes longi.	
Calcanea.	Extensores breves.	Tendines Extensorum propriorum pollicum. Tendines Extensorum longorum. Tendinibus minimorum digitorum exceptis.
	PHALANGES PROXIMALES.	
	Interossei *.	Tendines Flexorum longorum.
Tendines Flexorum longorum.	Lumbricales.	Tendines Flexorum longorum.
	PHALANGES MEDIÆ.	
Calcanea. Aponeuroses plantares.	Flexores breves perforati, seu Sublimes.	

* Vide Not. Pag. 22[illegible]

	PHALANGES DISTALES.	
Tibiæ. Fibulæ.	Flexores perforantes, seu Profundi.	
	MUSCULI PROPRII.	
	MINIM. DIGIT.	
Ligamenta trochlearia Peroneorum longorum. Metatarsi digit. quint. Ossa cuboidea.	Flexores breves.	Phalanges proximales.

[illegible]

CHAP. II.

GENERAL OBSERVATIONS.

Muscles are the organs which change, regulate, and fix the positions and attitudes of the system, and which are directly or indirectly concerned in all the more conspicuous motions of the solids and fluids. In these numerous and important operations they exhibit phenomena peculiar to themselves, and which cannot be traced to gravity or impulse, to elasticity or to chemical attraction. They produce their effect, whether it be a state of motion or rest, by contracting their fibres in consequence of stimulants; while the stimulants, whether chemical, mechanical, or vital, seem to act through the medium of a nervous energy.

They are not restricted to any length, breadth, or thickness; to any form, magnitude, or colour; though every one belonging to a pair resemble its fellow, and all the muscles of one individual be analogous in form, colour, attachment, and function, to the correspondent muscles of another of the same species.

They are not found of any one homogeneous

substance, but composed of carneous and tendinous fibres, interspersed every where with cellular membrane, and the ramifications of arteries, veins, absorbents, and nerves, all of them alive, and all of them irritable.

The Carneous Fibres.

The *carneous fibres* constitute *flesh*. They seldom or never appear single, but are collected into small fasciculi, that unite to form larger fasciculi; which larger fasciculi being united, form the collections which, with their tendinous fibres, &c. we call *muscles*, and which we distinguish by proper names.

The carneous fibres are all sensible to stimulants of one kind or another; and being the only parts that contract in obedience to the will, or in consequence of stimulants operating regularly, they constitute the distinguishing character of muscles. As they derive their principal power from a vital source, the change produced upon them by death is sudden and obvious. Hence the muscles that, when living, could have ruptured their tendons, luxated the bones, or broken them to pieces, can scarcely, when dead, if it were not for their tendons, their cellular membrane, and the ramifications of the sanguiferous and absorbent systems, support their own weight. In the living state, it is obvious, however, that their strength must vary, and in a great measure depend on the nature

and degree of the energy communicated. In the voluntary muscles, that energy, to a certain extent, is varied at pleasure: and hence it is, that, by a simple act of the will, the smaller muscles are frequently observed to overcome the larger; the flexors to overcome the extensors; the extensors the flexors; and that both, when we choose, are observed to balance their relative forces, and to fix the intended position of the parts. Yet the influence of the will is nothing, compared to the influence of instinct, emotion, and passion, to which the will is frequently subservient. These often affect the whole of the muscles, and through their medium alter the secretions.

It is this connection between muscular action and the vital powers, that explains those extraordinary changes which take place in the system of credulous persons, whose fancies are under the impressions of witchcraft, insanity, galvanism, of animal magnetism, or animal electricity. And the same connection likewise explains how our muscular strength is varied by the states of sickness and health; and how our exertions are more or less vigorous and extensive, continued for a longer or a shorter period, and attended with greater or with less fatigue, in proportion as the mind happens to be influenced by the exhilarating or depressing passions.

The degrees of force thus arising from volition, not only being different in different muscles, but in

different parts of the same muscle at the same time, as may be seen in the common flexors and the common extensors of the fingers and the toes, have with justice been regarded, not only as proofs of the singular influence, but superintendence, of the vital principle in the animal system. They are proofs, however, neither stronger nor clearer, nor of a much more frequent occurrence, than what we observe in those cases where chemical and mechanical stimulants are applied so as to excite painful sensations. In these instances, it is often not the muscle more immediately affected that is thrown into action, but those muscles, whether distant or near, that are best calculated, by their joint operation, to alleviate the feeling, to remove the cause by which it is occasioned, or to withdraw the part from the injury to which it is exposed. Thus when the fauces are tickled with a feather, it is not the muscles most directly affected that are thrown into action, but the stomach from a distance gives the alarm; when instantly the abdominal muscles, and diaphragm, and all the muscles concerned in respiration, hasten to unite in the general support of the common cause: not indeed as if they were the only organs interested, but the only organs that are able to bring the speediest assistance in such an emergency.

The Tendinous Fibres.

The *tendinous fibres* constitute tendons, or those parts which in common language are denominated *sinews*. They are quite insensible in the healthy state, are somewhat elastic, but never contract, like the carneous fasciculi, in consequence of stimulants obedient to the will or operating regularly. In their general appearance they bear a resemblance to some of the ligaments attached to the bones, and indeed are the media through which the carneous fasciculi in general are attached to the skeleton. In all the muscles of the same name belonging to a species, they have a similar form and situation, and are generally thought to bear a much greater proportion to the carneous fasciculi in the muscles of the active, vigorous, and adult, than in those of the indolent, feeble, and young. In the human body, they occupy the spaces where the carneous fibres could not be admitted without increasing both the weight and the bulk of the parts, requiring at the same time a considerable increase in the surface of attachment, and a change in the form and magnitude of the bones; the spaces likewise where the forces of the several carneous fibres are most concentrated; the spaces where either the pressure or friction would be injurious to the carneous fibres, and to that size of nerves and of vessels with which they must always be necessarily ac-

companied. As to their connection with the carneous fibres, the carneous fibres are sometimes attached to them at their extremities, sometimes at one side, sometimes at both; sometimes at one angle, sometimes at another; but always according to certain specific and determinate laws, as they regularly observe the same form, course, and attachment, in every muscle of the same name belonging to the species. By this contrivance, independently of bulk, not only is the strength and the form of the muscles, but their force, their extent, and their mode of action, in many respects, wonderfully varied to suit the several situations and circumstances where their functions are required.

As some muscles (for I speak not here of the contradictory and various reports that are founded on microscopic observations); as some muscles, so far as they appear to the naked eye, are without tendons, we cannot suppose that tendons form an essential character of the muscular system; though, by their variety of form and situation, they are well calculated, with uses, attachments, and other circumstances, to constitute those secondary characters by which one muscle is distinguished from another.

In some muscles, the tendinous fibres are closely interwoven, as it were, with the carneous; in others, they form a tendon in the middle between the two fleshy extremities; in a third variety, a part of the tendon is made to divide the muscle longitudinally, while the carneous fibres enter

obliquely on each side*; in a fourth variety, the carneous fibres enter the tendon on one side only; in a fifth variety, they begin with a tendon towards their origin; in a sixth, they have a tendon towards their insertion; in a seventh, they have a tendon at origin and insertion; in an eighth, they have several tendons in these situations; and in many muscles the varieties are mixed.

As the strength of the tendons, like that of the bones, ligaments, membranes, and cartilages, depends but little, after they are formed, on the nervous energy, the changes induced upon them by death are slow and imperceptible, in comparison of those which are induced on the carneous fasciculi: and hence we observe, that the tendinous portion of every muscle is decidedly the strongest in the dead body, although often found to be the weakest in the living.

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* Although, from the line that runs longitudinally, dividing the rows of carneous fibres, these muscles have been named *penniform*, there are other circumstances that characterise them. Besides what is common to many a muscle, a tendon both at origin and insertion, they seem to have regularly a tendinous expansion alternately on the dermal and the central aspect; so that whenever they are found to be tendinous on one aspect, in the part which is opposite of the other aspect they are found to be carneous, and *vice versâ*.

The Cellular Membrane.

The *cellular membrane*, which is more or less dense and elastic according to circumstances, is interposed between every muscle, between every fasciculus and every fibre, so far as we can trace them. It envelopes every artery, every vein, absorbent, and nerve; and at the time it maintains a connection, it preserves a distinction, officiating at once as a fascia, a ligament, and a mucous gland. In this last capacity it lubricates the parts with which it is in contact, diminishes friction, facilitates motion, prevents adhesions, and, where it is necessary, contains a quantity of oil in its cells, in order to mix it with the mucous secretions. It is also interposed between the integuments and the muscles beneath, where it generally contains a large quantity of adipose matter, which, from being a bad conductor of caloric, contributes to preserve the temperature that is necessary for the due performance of the several functions. It contains this matter in large quantities, where the temperature is defective for want of exercise, as in indolent persons and very young children; in large quantities, where the temperature is likely to prove defective from the natural state of the circulation, as on the sternal part of the abdomen, where the tendons, as usual, are supplied with but small branches of arteries; in large quantities, where it is af-

terwards to be used as nourishment, as in many animals that are regularly subjected to the torpid state, that lie down fat in the end of autumn, sleep through the winter, and awaken emaciated upon the genial approach of spring. It has often been remarked, that fat sheep support abstinence better than the lean; that some buried in the snow for weeks have been taken out alive; and that others have lived, *cæteris paribus*, longer or shorter, proportioned to the quantity of their adipose substance. That this substance is consumed in disease, when we are incapable of taking the regular supplies of food, or converting it into chyle, is a fact too generally known to require proof: that it is absorbed in a state of health, is far from improbable. It is a reservoir from which the system may be so far supplied in a uniform manner, and by which the changes arising from occasional and irregular diet may, to a certain extent, be counteracted.

From the extensive and general distribution of the cellular membrane; from its accompanying every artery, vein, absorbent, and nerve, and intermixing with every organ on which these are ramified; from its various degrees of elasticity and density in different situations and different regions, it is not unlikely that it performs some general function necessary to every part of the system, but varied somewhat according to circumstances. Different organs secrete and assimilate different substances from the sanguineous fluid; different nerves

and different vessels have different offices: And as nerves and vessels are all enveloped in cellular membrane, it is not improbable that in all it influences their action, and thereby contributes, with other causes, to accommodate the arteries, the veins, the absorbents, the nerves, and the organs on which they are ramified, to perform each their appropriate modifications of function. It is well known that diseased appearances are often confined to the cellular membrane; and that where such appearances exist in any of the organs, or around a vein, an artery, or a nerve, they exhibit the symptoms of a morbid action*.

The Arteries.

The larger branches of arterial vessels that are ramified in the muscles contain red blood; the smallest branches, particularly in the tendons, contain only a part that is transparent. All are meant to convey nourishment; and as no fluid is known to exude through inorganic pores in the living body, some of their ramuli must terminate in the carneous or tendinous fibres, where they deposite a part of their contents, that by the process of assimilation is retained, and assumes the character and appearance of the parts with which it is united.

Arteries are elastic in their longitudinal and

* Vide Anatomie Generale, par Fra. Xavier Bichat. Tome premier, du Systeme Cellulaire.

transverse directions, and have different diameters at different times, according to the quantity of blood they contain, and the force of the heart by which that is propelled. In the living body they are always full; though, from the interrupted supplies of the heart, the blood does not flow through their larger branches in a uniform stream; wave is supposed to succeed wave: and this notion is said to be strengthened from the jets of an artery when it is opened, and from the pulsation of those which are felt towards the surface. In the smaller branches, the undulatory motion is supposed to cease, although, when the eye is assisted by the microscope, we see globule following after globule in the web between the toes of a frog; and altho' in paronychia, we are, by a kind of internal feeling, made as conscious of pulsation at the point of a finger, as we are by the touch of the radial artery, where it beats near the carpus. The question is here, Is the sense of touch and unaided sight the only evidence by which we can form an opinion on the subject?

As for the expression *undulatory motion*, it is not correct; it transports the fancy to some watery expanse, where it sees wave following after wave in numerous succession at the same time. In the blood each wave is observed to cease ere another begins: It arises from the contraction of the heart throwing an additional quantity of fluid into the arteries at one extremity, and displacing a propor-

tional quantity at the other: The impulse is felt through all the parts of the system at once, similar to what we often observe in the action of a pump, where the water does not merely flow, but is forced by repeated strokes, through a narrow aperture; and the tendency of the pipe to occasion a recoil, and to throw it backwards, resisted by valves. The waves or pulses which are thus produced by the action of the heart are varied in force, velocity, magnitude, the regular and irregular order of succession; and these differences being variously combined with several kinds of vibratory motion, occasion a part of that almost infinite variety of effect, from which some, by feeling the artery at the wrist, attempt to ascertain the nature of disease, to predict its duration, its periods of change, and its mode of termination.

If we attend to the course of the arteries, we shall not find them always running in a straight line from their commencement to their termination, but shall generally find them in those situations where they are best protected and secured, and are best enabled to perform their functions with the least chance of interruption or danger.

If we attend to their ramifications, we shall usually find, that they are sent to parts in the vicinity; or if they be sent to a greater distance, that they undergo changes in their course that require the length of space which they occupy; that those situations in which they originate are more favourabel for receiving the blood than those which are

near; that the longest course is decidedly the safest; or that the parts to which they are destined require to be furnished with branches proceeding from different quarters, in order to insure at all times a regular supply; a circumstance, by the way, which seems partly to explain those communications that every where take place among vascular branches of the same class, whether they be arteries, veins, or absorbents. I have said *partly*; as these plexuses, with the different angles at which the branches arise from the trunks, with the different modes of division and union, with the different convolutions and serpentine windings, contribute also, not only to modify the action of the heart on the several fluids, but likewise to accommodate the state of the fluids to the nature of the organs, to that of the secretions, and the other functions in which organs are employed.

The Veins.

As the blood cannot return to the heart by the way it goes out, on account of the valves placed at the commencement of the two great arteries, it proceeds onward till it enters the veins. Now the veins, in a vague and general sense, may be considered as the arteries reflected with a change of diameter, appearance, and structure, to convey the blood in a retrograde course, whether from the lungs or the system at large, back to the heart.

In the human species the heart is situated in the

region of the thorax, enclosed in a capsule, and this capsule surrounded by the lungs on the sternal, the dorsal, and the lateral aspects. It is formed of a strong and intricate texture of muscular fibres: It has two cavities that are named *ventricles*, with an imperforated septum between them. By a lateral opening, each of the ventricles receives blood from a venous reservoir of a muscular structure, that is termed a *sinus*. By another opening towards the base, they afterwards propel it into an artery; the entrance at the side, and the exit at the base, being furnished with valves to prevent its return.

The blood, changed by the action of the lungs and the air that is inspired, is collected by veins, which, after a number of reiterated unions, at last terminate in four large trunks: These trunks discharge their blood into what is called the systemic sinus; that sinus, by muscular contraction throws it into the systemic ventricle; the systemic ventricle, with greater force, throws it afterwards into the aorta; the aorta, which is highly elastic, if not likewise muscular, by reiterated divisions transmits it through every part of the system. From these parts the aortal branches, when they are reflected with a change of diameter, appearance, and structure, become veins; these veins, by reiterated unions, terminate at last in two large trunks, which are named *cavæ*; the cavæ discharge their blood into the right or pulmonic sinus; that sinus, by

muscular contraction, sends it towards the pulmonic ventricle; that ventricle, having a greater muscular power, throws it into the pulmonic artery; and that artery, by its numerous branches, disperses it through the lungs, to undergo the change that is necessary from the action of the air; after which it is received again by the veins, with which we began, and conveyed again to the systemic sinus and ventricle, to be distributed as before to the system at large.

From this account it evidently follows, that one set of veins in the human body, and in all animals that are similarly constructed, collects the whole of the blood from the lungs to be transmitted through a heart and an artery to the system at large; that another set is made to collect it from the system at large, to be transmitted through a heart and an artery into the lungs: Or, in other words, that one set of veins, together with a sinus, a ventricle, and an artery belongs to the system; and another, with a sinus, a ventricle, and an artery, to the lungs as an organ of respiration. The first set of veins, with the other parts connected in function, and *conveying blood of a florid red colour*, is here distinguished by the epithet *systemic*; the second, and the organs connected with it, *containing blood of a dark purple colour*, by the epithet *pulmonic*. The distinction is made rather to point out their function than position; and the reason of this will soon be apparent. Both systems have their hearts enclosed in the same capsule, and the two hearts

are so closely connected that we might suppose the two to be one, were it not for the septum that appears on dissection. The pulmonic system has all its arteries, and the systemic all its veins, ramified on the lungs; and as the systemic has its arteries every where, so has the pulmonic system its veins. In short, wherever we see the arteries of one system, we see the veins of the other accompanying them; and *vice versâ*. Hence the distinction as to situation being impossible, it occurred to anatomists to distinguish them, by their functions, into that, which from the system carries the sanguineous fluid *pulmonad*, or towards the lungs; and that, which from the lungs carries it *systemad*, or towards the system *.

All veins have either a course peculiar to themselves, or are seen to follow the course of the arteries; those which observe a course of their own are generally superficial; those which follow the course of the arteries, generally deep, and are known by the name of *venæ satellites*; two venæ satellites usually accompany each of the larger branches of arteries in the atlantal and sacral extremities.

All veins of the human body that are ramified on organs subjected to varied and extensive motions, and particularly motions of the voluntary kind, are furnished with valves; and hence in amputations of the atlantal and sacral extremities

* Vide Anatomie Generale, par Fra. Xavier Bichat.

ligatures around the veins are unnecessary; as valvular veins, when divided across, require a ligature only at the orifice which points towards the heart.

In all veins, except the *vena portarum hepatica*, the blood flows from the branches to the trunk, or from vessels of a less to vessels possessing a larger diameter, contrary to what takes place in the arteries. In such vessels, where there is no cause of obstruction, the blood, from meeting with a less resistance than it does in the arteries, has less occasion for a *vis a tergo*, like that communicated by the impulse of a heart. The heart, however, may be supposed to assist the motion of the venous blood; as the force which throws an injection into the arteries will often make it return by the veins. But another cause besides the heart, the pulsation of the arteries, and the elasticity of the veins themselves, is the action of the organs on which the venous branches commence, and along which they afterwards run. This action, while it retards the blood in the arteries, will generally promote its circulation in the veins; and in those cases where this action is constant and uniform, and the organs through which the veins have to pass, are not subjected to changes of form, or to great varieties and extent of motion, it will, without the assistance of valves, enable the veins to propel the blood from the trunk to its branches, as in the *vena portarum hepatica*.

The motion of the blood in the venæ satellites is particularly promoted by the pulsation of those arteries with which they are in contact; and the motion of the blood in the subcutaneous or superficial veins, by the elasticity of the integuments. These two sets, which have frequent communications, are well calculated to assist one another: for when the muscles are thrown into action, the blood may flow, and actually flows, in greater quantity into those veins which are subcutaneous; and when the integuments are contracted or compressed, it flows in greater quantity into the satellites*. Their mutual aid, however, is not neces-

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* As there are few who have not observed the swelling of the subcutaneous veins on the back of the hand when warmed at a fire, and who have not noticed their gradual enlargement upon the face, and over the distal parts of the extremities, when the integuments are flaccid through age, it is not surprising that the application of cold and of bandages, when skilfully managed, should have been found so generally useful in cases of disease where the distension of these veins had either produced, or threatened to produce, that unseemly appearance which is termed *varicose*. If such remedies were resorted to in time, they might often save the trouble of that operation, where the trunk of the varicose vessels is laid bare, and after being cut is tied with a ligature at the orifice pointing towards the heart, the only ligature, as already observed, that in general is necessary; for should a branch open near the orifice that points distad, and on the distal aspect of the valve, the retrocession of the venous trunk, with the consequences that follow, will in most cases prevent any hemorrhage.

sary merely in the voluntary actions of the muscles, or when the integuments are contracted by cold; it seems to be necessary in a great variety of mental emotions, in various diseases, and in modes of respiration; for in many of these we see often the blood hastening to the surface, and in many retiring from it as suddenly.

There is some peculiarity of circulation within the cranium. The dura mater and the pia mater are not supplied with the same branches. As the one is stationary and the other moveable, the delicate functions of the cerebral substance might not permit the chance of interruption in the circulation of the veins or the arteries as they pass between the membranes. The veins, however, of the cerebral substance, and which are ramified on the pia mater, convey the whole of their blood from the centre towards the circumference; and although they collect none of their blood from the dura mater, they discharge their contents into its sinuses. They are assisted in performing their functions by the general resistance made by the cranium, by the combined pulsation of the arteries, and by those motions of the cerebral substance that are the consequences of respiration.

From the sinuses occupying various situations, glabellar, coronal, inial, and basilar, and extending basilad towards the dextral and sinistral aspects, and where they are basilar, extending laterally dextrad and sinistrad, the veins, by entering

those which are nearest, run comparatively but a short course; and then when their blood is lodged in these sinuses, it can neither accumulate to injure the brain, by occupying more than its own space, nor have any chance of rupturing its canals, either from its quantity, or the more than ordinary agitations of the head.

In the eye, the brain, and other situations where the veins and the arteries are seen to observe different courses, it must be obvious that the parts around them may be differently affected at the same time; that the blood may be accelerated in one set of vessels, while it is proportionally retarded in the other; and that the circulation may in this way be varied, not only to suit the operations of the organs, but to accommodate these operations more readily to volitions, emotions, and passions, and the other causes that affect the circulation, as it is often seen in the voluntary organs, from the two sets of veins.

A different reason must be assigned for that peculiarity of the venous circulation which has been remarked by every anatomist in the cavity of the thorax. The *cava inferior*, which returns the blood from the sacral extremities and from the abdomen, has no course to run in the thorax. On receding from the bodies of the lumbar vertebræ, and receiving the blood that circulates in the liver, it immediately afterwards perforates the diaphragm; and no sooner perforates than it

also terminates, discharging its contents into the right or pulmonic sinus. From this circumstance the inferior venous intercostal vessels cannot send their blood to it, without taking a circuitous course, passing through the diaphragm, entering the abdomen, and exposing their action to many interruptions. Nay, even were the *cava* continued in the thorax, as we commonly see it in the lower animals, yet still the intercostals could not enter it with safety, on account of its distance from the bodies of the vertebræ, and the want of support in the intervening space. For these reasons, the inferior intercostals run mesiad, following, however, the curvatures of the sides, and enter a vein, called the *vena azygos*, resting on the vertebræ, and situated on the right side of the aorta. This vein, as it passes along, receives the blood from all the inferior intercostal veins (not unfrequently from some of the lumbar, where the *cava inferior* recedes from the vertebræ); and proceeding atlantad as far as the third of the costal vertebræ, advances sternad, sinistrad, and sacrad, and, forming a curve, discharges itself into the vena cava superior, where its blood mingles with that from the head, the neck, and atlantal extremities, and from the thoracic, the superior intercostal, and the two internal mammary veins.

This vena azygos, which receives the blood from the intercostals, being situated on the dextral side of the aorta, where it lies in the thorax, for

the same reason that the *cava inferior* is situated on the dextral side of the aorta, where it lies in the abdomen, that it may be near the pulmonic ventricle, many veins on the left, in their transverse passage, must cross the arteries either on the dorsal or the sternal aspect, and have their circulation occasionally interrupted, or at least more impeded, than the corresponding veins on the right. To this circumstance Morgagni has ascribed the greater frequency of disease in the left than the right kidney*, and appears strongly inclined to believe that a similar difference will also be found between the left and the right ovarium†.

If the cause which he has supposed be the true one, it should also follow that the left side, in the region of the thorax, should be more liable to disease than the right, as its venous intercostals have to pass dextrad, between the aorta and bodies of the vertebræ, to the vena azygos. Now the questions will be, Is the left side more liable to disease? Have any observations been made upon the subject? and, Do these observations countenance the hypothesis? On a cursory view of the Letters of Morgagni *De Sedibus Morborum*, I found, that of eighteen females that had been affected on one side, there were only four affected on the right;

* Epist. XL. § 13.

† Epist. XXXIX. § 40. De Sedibus Morborum.

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but that of males an equal number, or rather a greater, were affected on the right. The cases of the females corroborate the hypothesis, while those of the males seem to overturn it, if we are not to suppose, with respect to the males, that the right hand being more frequently employed than the left, its habitual, vigorous, and extensive exertions were greater disadvantages to the right side than the unfavourable courses of the veins were to the left.

Much has been said of the difference of function observed between the right and the left sides; and much has been ascribed to the difference of manner in which the carotid and subclavian arteries, on the two sides, arise from the aorta. But let it be considered, that if the subclavian and carotid artery of the right side did not originate from a common trunk, the subclavian must have risen at the very commencement of the aorta, and its orifice, far from the bend of the arch, been unfavourably situated for receiving the blood; or the arch of the aorta, as sometimes happens when these two branches arise separately, must have been somewhat different in form, and extended more widely from right to left, to furnish space for the separate origins. To such a difference with regard to structure, we can therefore ascribe but very little difference as to the functions. The apparent variety seems rather calculated to preserve a similarity, than occasion a distinction, as to effect between the two sides.

The other differences are far from being so easily explained. The eight pair of nerves, as well as the arteries, regularly exhibit different appearances on the right and left, and particularly with respect to those branches that are called recurrent; the one on the right being reflected around the right subclavian artery, and the one on the left around the aorta. The great trunk, too, of the absorbents, from following the aorta, and avoiding the œsophagus, terminates in the veins of the left side; and at the angle where this trunk enters, the left subclavian and internal jugular form also a trunk that runs transversely on the sternal aspect of the carotids to the cava superior, and unlike to any venous distribution that is seen on the right: And yet what can we infer from all these differences, from the particular position of the heart, from the situations of the stomach or liver, or from the lungs of the right side having one lobe more than the lungs of the left? Certainly very little. For notwithstanding this difference of structure, the difference of function is not very obvious. Many operations, it must be confessed, are better performed by one hand than by two; and whether the one or the other be employed, will depend very much upon choice. Both hands frequently cooperate, and in many cases both are equally fitted to perform every part of the common labour. If there be cases where the labour is divided in such a manner that each performs, and

can only perform, a particular part, may not this division, in most instances, be traced to fashion and to previous habit? and is it not likewise in consequence of fashion, that when any individual happens to deviate from the usual practice in assigning to his hands their share and proportion of any operation, we are induced to call him *left-handed?* while the left-handed, to avoid the reproach which fashion attaches to what she considers as inattention, vulgarity, or awkwardness, sometimes pretends to be ambidexter; a pretence that has often a ludicrous effect when brought to the test of actual experiment, for who has seen any that, strictly speaking, can be called ambidexter? I believe none. To do a thing well, and particularly any thing that requires much study and practice, the hand that performs it, be it right or left, must be trained for the purpose.

The influence of habits, the undefined capability of the organs, the numerous resources of the vital principle, and the power which it has of accommodating the system, and parts of the system, to various operations and to various circumstances, are things with which we are but little acquainted; and ignorance here, if attended with presumption, must frequently lead to hasty experiments and to hasty conclusions, in deciding upon what are causes and effects in the animal œconomy. If we can hardly therefore deny, we can hardly with any confidence assert, that the differences which we see

between the structure of the two sides are the causes of the preference which is generally given to the right hand over the left. That the arterial and venous systems exhibit varieties of ramification, is easily demonstrated, and that these varieties are each of them suited to the nature and functions of the several organs to which they are destined, is probable from almost every observation. We see that amidst the number of changes which take place at birth, the nature of the whole circulation is altered; the umbilical arteries and vein, the *ductus venosus* and *ductus arteriosus*, gradually obliterated, and other vessels as gradually enlarged. We daily see changes in the size, the anastomoses, and the ramifications of the smaller branches; and we see these changes attendant on tumours, on inflammation, and on the varying states of the organs. We see the changes of ramification in the atlantal and sacral extremities proportioned somewhat to the varieties of voluntary motions, and are led to expect them fewer in number where the motions are regular and less extensive. At the same time, a difference of structure in any of the organs does not always imply a difference in the ramification of its vessels. The same vessels, without any change as to structure or appearance, may be capable of great varieties of action; under the influence of emotion or passion, they can alter the qualities of the blood in a moment, as we learn from several experiments of Hewson; and in cases of injury, we see not only their action accommodated, but new vessels some-

times produced, the old ones repaired, and sometimes obliterated, as best suits the object, which we know from experience to be the object in view. In short, no subordinate part of the structure the nervous system only excepted, seems more immediately under the influence of the vital energy than the sanguiferous; and considering its wonderful effects on the blood, it should not by any means appear surprising, if some, from a cursory view of the phenomena, should have imagined that there was a sort of life in that fluid.

THE ABSORBENTS.

MANY of the smaller branches of arteries, which are not reflected to form veins, are known to terminate on the surface of the skin, on the surface of the several internal cavities, in the excretory ducts of different glands, and in the various organs of the system. The fluids which they discharge on the surface into excretory ducts, or into cavities that have ducts or passages opening peripherad, are either expelled, or may be expelled, entirely from the system; but the fluids which they deposite in organs, that part may be assimilated in growth and nutrition, and the fluids discharged into shut cavities, to lubricate the parts, to facilitate motion, and prevent adhesion, must, if they flow in regular succession, be either accumulated, or returned to the heart by veins, or by some other system of ves-

sels. They are known to be returned by a set of vessels that are named *absorbents.*

The absorbent vessels are generally found lying by the sides of the veins and the arteries, but so very small, that the diameter of the common trunk, in which most of them terminate, is seldom larger in a healthy person than that of a crow quill. They all terminate ultimately in the veins that are called *pulmonic.* In most animals they all, like the veins belonging to the head, neck, and extremities, are very plentifully furnished with valves; and they all, like the veins, convey their fluid, in the first instance, from branches to trunks: or, should any of them happen to pass through glands, like the *vena portarum*, they transmit it alternately from branches to trunks, and from trunks to branches. In other respects they differ considerably. With regard to number, the density, thinness, and transparency of their coats, they exceed the veins as much as the veins are usually known to exceed the arteries.

They may be divided into different sets according to their offices and their commencement. Those commencing from shut cavities, from arterial branches, or the substance of organs, may be considered as accessory veins, conveying back a part of the fluids that had been sent from the heart by the arteries. But as the fluids sent by the arteries are sometimes assimilated and become solid, sometimes undergo morbid changes, and sometimes, when assimilated, separate again and be-

come fluid, these absorbents are also employed to return whatever is morbid or decayed, that it may mingle again with the blood, be made to undergo new preparations, or be thrown entirely out of the system.

In this class, the existence of those which are said to commence from arterial branches has been called in question: But as Mr Cruickshanks seems to have proved it both by experiment and observation, the business is now, to ascertain, if possible, their uses; and though this be a task which we cannot presume to execute with great minuteness or accuracy, we are certainly entitled to draw the conclusion, that by such vessels the quantity of thin and transparent fluid that flows in the branches of arteries or veins, or that is deposited on surfaces or in organs, may be variously regulated.

The other sets are those which commence from the surface without, and the alimentary canal within. All living bodies, in their earliest state, are nourished by absorbents commencing from the surface, or from organs beyond it; the vegetable tribes, through the whole of their lives: but the animal tribes, as soon as they begin to receive food, in consequence of their own voluntary exertions, by absorbents also, commencing from an alimentary canal. This canal, by no means intended as a mere repository of nutritive stores, nor to save the trouble of constant exertion in procuring the necessary supplies of nourishment, is differently con-

structed in different animals; and, according to the species, is provided with different instruments and juices to prepare the food, to adapt it to the system, and to render it fit for entering the absorbents. From the qualities of our fluids depending so much on its previous operations, we are led to conceive how the general health is so much regulated by the stomach and intestines; and in some measure are able to explain how medicines, directed to a part of the system which exercises so general an influence over the whole, should, if skilfully employed, prove singularly useful in various diseases, and should, from the parts to which they are applied being more within our reach than any other part, excepting the surface, have also their effects better ascertained, and be under more obvious and accurate management than medicines of almost any other description *.

The absorbents commencing from the surface of the body may, at all the different periods of life, be easily demonstrated in the genus Rana, as the individuals belonging to that genus may be shown to increase in bulk and in weight when aqueous fluids are applied to their skin. In man, indeed, and in many other animals, absorbents commencing in that situation to convey nourishment, or to supply the place of respiration, become less ne-

* For the singular effects of medicines directed to this part of the system under skilful management, see Hamilton's Observations on Purgative Medicines.

cessary, as their respiration cannot be suspended, and as their nourishment is principally, or almost wholly, conveyed by absorbents commencing from the central surface of the alimentary canal. On these accounts, the effects of absorbents commencing peripherad, being neither conspicuous, nor perhaps very regular, in the human body, some physiologists have lately begun to deny their existence; and to deny it because the fluids, in some of their experiments, when applied to the skin, were not sensibly absorbed. Without questioning the certainty of the facts, or doubting the veracity with which they are narrated, it may safely be said that the conclusion has been hastily drawn. In these experiments it was taken for granted, that all liquids, if equally fluid, and if not obviously injurious to the system, would, at all times and in all circumstances, be readily absorbed, provided absorbents opened from without. These are postulates that cannot be admitted: Much may depend on the state of the fluid, as being a liquid, a gas, or a vapour; much also on the properties of the fluid in these different states; much on the state of the system and integuments, and the state of the absorbents at the time of the experiment. All agree that the scarf-skin is porous, and that it is perforated by exhaling vessels; all agree that absorbents commence immediately beneath it; and all agree, whether they happen to commence or not from its peripheral or outward surface, that mercury, by a little pressure or friction,

may be made to enter them. Nor let us infer from the pressure and friction, that the scarf-skin is destroyed; we can here appeal to the evidence of sense, which demonstrates the contrary. The absorbents at times are certainly, not more than the veins and the arteries, totally independent of mechanical aid. From the greater degree of resistance that is made by the bones of the cranium and the vertebral tube, we can see the reason why the Spina bifida never takes place but in very young children, and why the Hydrocephalus internus occurs less frequently in adult persons than in those where the sutures of the cranium are open; or the head is expanding in consequence of growth. We may also see how, from the want of mechanical aid, the water is often apt to be accumulated in the sacral extremities, where the integuments are much relaxed, the motions languid, the position erect, and the system debilitated; and how this absorption is afterwards promoted by the pressure of bandages, the change of posture, and the restoration of the skin and the muscles to their healthy functions.

The Nerves.

Every nerve that has yet been discovered in an animal body regularly formed, has proceeded directly or indirectly from a *cerebrum*, a *cerebellum*, a *medulla oblongata*, or *medulla spinalis*: the two former are what principally constitute the brain. They may each be divided, and are partly divided,

into similar halves towards right and left; each of the halves sends forth a pedicle, pedunculus, or crus; these pedunculi or crura afterwards unite, and form what is called the *tuber annulare*: from the tuber annulare to the foramen magnum of the occiput, with a change of form, they take the name of *medulla oblongata*; and this medulla, after entering the vertebræ, is, almost without any change of appearance, called *medulla spinalis*. The medulla spinalis, as remarked by Soemmering, bears a greater proportion to the contents of the cranium in the lower animals than it does in man; and for this reason, that as we descend in the scale of being, the brain is observed to grow proportionally smaller and smaller. In amphibia, and a great number of fishes, the diameter of its cavity becomes so small as scarcely to exceed even the diameter of the vertebral tube. In the tribe of insects it entirely disappears, leaving only a spinal marrow and nerves; and even a spinal marrow and nerves are sought for in vain in the families of plants.

The laws by which these phenomena are regulated may partly be traced. The nerves distributed to the organs of sense and voluntary motion are, compared to the parts on which they are ramified, proportionally the largest in the whole system. The radial, the ulnar, or the median nerves, are larger than the middle or great sympathetics, that supply the viscera of the thorax

and abdomen; and the digital branches, at the points of the fingers, are larger than those which are seen entering the basis of the heart. In those parts which are naturally insensible, the vestige of a nerve is never to be seen; nor would ever the existence of a nerve be suspected, unless from occasional degrees of sensibility when the parts are morbid. Even in the parts which are naturally sensible, but not organs of sense or voluntary motion, we should hardly be able to trace any nerves, if we were not previously acquainted with the trunks from which they are derived; and should hardly be able to decide on the nature of the trunks themselves, if we did not trace them to others that are larger, and these to the brain or the spinal marrow. Reasoning, therefore, upon the principles of general analogy, we need not be surprised that a nervous system, supposing a nervous system in plants, should escape even the most penetrating sight, when searching for it in those organic bodies that are destitute of brain, of spinal marrow, of sense, sensation, and voluntary motion.

All nerves have been divided into those which are sensible or insensible, voluntary or involuntary: the sensible being those which obviously and suddenly communicate intelligence to the vital principle, of the injuries or changes that take place in the system, or of the impressions that are made from without; the insensible, those which perform their operations obscurely and secretely,

unknown to the senses, and without in general awakening our consciousness; the voluntary, those which are either subservient, or at least partly subservient, to the will; the involuntary, those, the functions of which are obvious to the senses, but on which the will has no direct or immediate influence. This division, although it be useful on certain occasions, is far from accurate. On looking for marked and permanent characters by which these kinds of nerves are distinguished, we perceive none. The distinctions are made to rest entirely on modes of action, on certain partial differences of function, and on partial differences that are liable to change.

The sensible nerves grow often insensible, and the voluntary nerves often involuntary, in consequence of palsy; while insensible nerves, on the other hand, are often observed to become sensible from the diseased state of the parts on which they are ramified.

Voluntary nerves, though generally sensible, do not appear to be necessarily so. There are voluntary nerves which are either insensible, or next to insensible, in some insects. When a gadfly has once fixed on the hand and tasted of the blood, its wings, its legs, its antennæ, and even abdomen, may be amputated without interrupting, or at least apparently, the pleasure which it seems to derive from the suction.

Involuntary nerves, although exempted from any direct influence of the will, are seldom ex-

empted from the effects of fear, of anger, or any of the violent mental emotions which affect indiscriminately both the voluntary and involuntary nerves.

Nervous branches, sensible and insensible, voluntary and involuntary, are known to arise from the same trunk; and as their functions are frequently varied by the state of the organ on which they are ramified, we are led to conclude, that a part of that peculiarity of function by which they are distinguished depends upon some modification at their distal extremity. This conclusion is farther confirmed by the nerves distributed to the organs of sense; for if these nerves be destroyed where they terminate, their whole peculiarity of function ceases. Nor can it be objected, that after amputation of an arm or a leg, a patient will complain of violent pain in the fingers or the toes of the separated limb. These feelings do not seem to arise from any irritation in the parts of the digital branches that remain; they are not perceived during amputation; they convey not, as before, any information of external objects, or of any injuries that have happened to the system; they are more like imposing dreams and deliriums, where the senses are supposed to have given their evidence in matters about which they never were consulted.

Other varieties with respect to their function may be traced to the energies of the vital principle; to the ramifications of the arteries and

veins; to the quantity, quality, velocity, impetus, and temperature of the blood; to the laxness and density of the cellular membrane; to the ramifications of the nerves themselves; to the courses which they take; to their plexuses and ganglions; and also to the parts from which they originate.

With these circumstances, we know in general, from repeated observation, that the functions of the nerves are somehow connected; although, as to that variety of function which belongs exclusively to each of the circumstances, we know very little: it being at all times difficult to say how much depends on the nature of the organs, how much on the agent that employs them as instruments, how much on the stimulants that prompt its exertions; the principal phenomena, in all living bodies, being generally the effects of a great number of causes combined—causes, too, whose actions are modified by the very effects to which they give origin; effects that in their turn operate as causes, and on many occasions produce effects similar to the causes that produced themselves.

As an intimate acquaintance with all the circumstances immediate and remote, on which a function, or the modification of a function, depends, is a knowledge to which we never can aspire; and as the light by which we are guided is a light in which distant and minute objects seldom appear, we must limit our desires to partial

glimpses, and must rest satisfied when these can be obtained.

As great differences in the general appearance of the nervous system are always accompanied with very obvious differences of function in the several classes and orders of animals, we shall only suppose that the smaller differences have proportional effects, though we cannot so easily or clearly demonstrate them. On inquiring into some of these smaller differences, we think we can see a difference of function arising from the course of the nervous branches that are called recurrents. These branches, proceeding from the trunks of the eighth pair, *par vagum*, or middle sympathetic, enter the thorax, transmit some ramuli to the cardiac plexus, and then, returning each round an artery, are ramified on the larynx, which they formerly had passed in their progress sacrad. In consequence of this singular course, when the action of the heart or arteries is changed, we generally find that a part of the change is indicated by the voice.

We see the nerves not immediately subjected to the influence of the will distinguished, not only by a proportionally smaller size, but likewise by certain swellings or knots that are named *ganglions*; and as all these nerves are subservient to functions that are constant and uniform, it has been supposed that their ganglions are both reser-

voirs and sources of the nervous energy; and that by affording a regular supply, and resisting those occasional commotions excited by volition, they are calculated to preserve that uniformity in point of function by which the involuntary nerves are distinguished.

The friends of this hypothesis, although they must allow that it is certainly far from demonstrable, may however maintain that it is supported by the phenomena of the nervous system that appears in insects. In these small animals, a nervous cord, that sometimes divides, sometimes unites, and always exhibits a number of ganglions, is observed to extend from the atlantal to the sacral extremity. The ganglions which it forms are the parts which principally send out the nerves: they send them out to parts in their vicinity; and these parts, from having derived their nervous energy chiefly from the ganglion, are observed, when separated from the rest of the system, to retain their independence as to irritability a considerable time; while the parts that remain equally independent, or more so, by their union, are but slowly affected, comparatively speaking, by the partial loss.

The principal objection to the hypothesis is what arises from some of the functions observable in the organs that are destined to perform voluntary motions. In these, as in all the organs of the body, there is a number of vital processes regu-

larly going on, independent of volition; and hence circulation, nutrition, absorption, continue in a muscle after it is deeply affected by paralysis. From this it must follow, that these kinds of functions are either performed without the assistance of any nerves belonging to the muscle; or that if nerves be actually concerned, they must terminate differently, have a different origin, or be somewhere in their course modified differently, from those which are voluntary. The answer which is given by those inclined to favour the hypothesis is, that the assistance of the nerves is necessary; but that there may be filaments in the same branch that differ as to origin, termination, and size, and as to changes that take place in their course: that the smallest branches which we can see with the naked eye appear through the microscope composed of fibres: that when these branches are traced to their trunks, and the trunks again to the spinal marrow, they are found to be partially connected with ganglions: that the spinal marrow, composed of the four crura of the brain, emits four rows of nervous filaments, two of them dextrad, and two of them sinistrad; one of the two issuing from a sternal, the other from a dorsal crus of the medulla; both of them collected into small fasciculi; and two fasciculi, a dorsal and a sternal, of which the dorsal has always a ganglion uniting to form each of the nerves that pass through the intervertebral foramina: that,

besides, if the crura be followed atlantad, they will lead to the ganglion called tuber annulare, where probably a considerable portion of the crura undergoes a change, that partly may contribute to modify the functions of those nerves that afterwards proceed from them: that all nerves, from the fifth pair inclusively, issue from the crura after the tuber annulare is formed: that each half of the first pair of nerves swells into a ganglion before it perforates the ethmoidal bone: that the halves of the second are observed to unite in the sella turcica, where they seem mutually to assist one another: that the third pair rises close by the edge of the tuber; the fourth, from the two of the corpora quadrigemina that are situated basilad: and that all the nerves in the human body are directly or indirectly, wholly or partially, connected either with ganglions or plexuses, or with both.

The use of the plexuses* is less obscure than that of the ganglions, and their appearance as different from the gangliform as the retiform texture of the absorbents is from their glandular-like convolutions. In the large plexuses formed by the nerves of the atlantal and sacral extremities, we see a number of communicating branches pass-

* I have added here an English termination to the word *plexus;* as the singular and plural of that word can only be distinguished by the meaning of the sentence in a language such as ours, where the adjectives are never, and where even the verbs are but sparingly inflected.

ing between one trunk and another, and which, like the inosculating branches of blood vessels, contribute to secure a more regular supply of that sort of energy which nerves convey to the different parts on which they are ramified. Such communications might naturally have been expected in all the other parts of the system; and accordingly we find that all the other nerves issuing from the spine, and severals from the head, although they be not mentioned as forming plexuses (which are merely connections of certain appearances), are nevertheless, near to their origin, connected directly or indirectly with the nerves in their vicinity, and frequently with others near their distal extremity, where they terminate in *ramuli*, or smaller branches.

In some cases the plexuses appear, as well as the ganglions, to be formed by the parts of the same nerve; in all cases the plexuses, too, as well as the ganglions, when not the effects of more intimate unions, are somehow preparatory to wider separations; in a few cases the appearances of both are closely intermixed; and in many cases they probably exist where the anatomist cannot easily discover them; as among the slender filaments of nerves, where these are concealed in a common sheath, or at the commencement of the nervous cords in the spinal marrow, medulla oblongata, or tuber annulare. Physiologists at least are accustomed to trace particular connections among the organs that, distant or near, derive their

nerves, not merely from the same ganglions or plexuses, but the same trunks, or the contiguous corresponding parts of the brain and its crura. It is thus they explain the sympathy between the eyes and the nose, when a strong light impinges on the one, or a pungent odour is applied to the other; that between the liver, at the coronary ligament, and the right shoulder; that between the diaphragm, at the pit of the stomach, and the muscles of the neck, in cases of tetanus; and, lastly, amidst a variety of others, that strong, marked, and general sympathy between the similar halves of the system. This last sympathy certainly implies something more than a mere similarity and contiguity of the respective nerves at their commencement; for, in reasoning from analogy, on looking back to the ganglions and plexuses, to the bones divided by the mesial plane, and to the trunks of the veins and arteries, with their branches ramified towards right and left, it seems also to imply a mutual, though partial, interchange of substance between the dextral and sinistral portions of the brain and its crura —a notion corroborated by decussating fibres that have been observed in the medulla oblongata, and by those not uncommon cases of palsy, where the brain and the trunk, so far as regards the voluntary functions, are known to be affected on the contrary sides.

If sympathies occur which cannot be explained

by these relations existing among nerves, it is not because these relations are useless, but because there are other sources of relation to be found in the system. Distant parts are related by absorbents, blood vessels, muscles; by a like sensibility with respect to stimulants; and by being concerned in different parts of the same common function, as the skin, the lungs, the kidneys, and intestines, in discharging the noxious or superfluous fluids; or distant muscles when they co-operate in some general movement or attitude. Besides, the great source of connection, and to which all the rest are subordinate, is that principle which regulates and presides, to which every impression is directed, and from which every vital action proceeds—a principle that makes every organ in the body to act and to sympathise with the whole, and the whole with every organ when necessary.

Of the parts composing the brain, or the *encephalon*, we may say in general, that, as well as the nerves, they are certainly organs of the vital principle; though, as to the kinds of particular functions in which it employs them, we be totally ignorant. What is more humbling, we can even say nothing precise and satisfactory of the general functions that distinguish the cerebrum and cerebellum. From the numerous varieties, indeed, that occur in the cerebra of different species of animals, and the few, comparatively, that are to be seen in their cerebella, we perhaps may venture on this

general conclusion, that the cerebellum is employed in functions that are common to various species of animals, and the cerebrum in the functions by which they are distinguished, as in those which regulate the differences of form, structure, arrangement; the differences of passion, appetite, and instinct. As for much more precise and particular conclusions, we have hardly any data on which we can proceed with confidence or safety; our modern craniological theories, like the fabulous tales of unknown countries, being calculated rather to amuse than instruct.

Life and Irritability.

The differences of function arising in the organs from a difference of substance and a difference of structure; from a difference in the veins, arteries, absorbents, and circulating fluids; from a difference in the cellular membrane and nerves, and a consequent difference of the vital influence—contribute to occasion those irritabilities which Harvey has denominated the *sensus proprii*. These sensus proprii, by a modern discovery, have been ascribed to *vitæ propriæ*. The vitæ propriæ are the functions personified; and though somewhat different, are yet somewhat akin to the *vis genitrix*, the *vis concoctrix*, the *vis medicatrix*, and the other *vires* of the old physiologists, who seem to have derived them from the Greek Δυναμεις,

mentioned by Hippocrates, and which were the ministers of Physis or Nature. They succeeded in office to the ancient Genii, that at one time had presided in the organs, and that had been accustomed, when they happened to meet with judicial astrologers, to regulate their conduct by the influence of the stars.

As the modern vitæ have all been reduced by the celebrated Bichat to two kinds, the *animal* and *organic*, the former distinguished chiefly from the latter by the functions, sensation, and voluntary motion; so the ancient Δυναμεις, the ministers of Physis, were classed by Plato under three souls, the *rational*, *animal*, and *vegetative*; a classification that, with little or no material alteration, was adopted by Galen, and by most of his followers.

With a little more patience they might all have been traced to a common source; for the truth seems to be, that all these functions, vitæ, faculties, vires, dynamics, or whatever be their names, originate principally from one cause, operating variously by various organs, and often itself operated upon by various causes, that in many cases, from the appearances of design and intelligence, seem to be under either the mediate or immediate direction of the Author of nature.

As for the hypothesis that admits the existence of vital laws and vital phenomena without the existence of a vital principle, it is scarcely intelligible. Laws, strictly speaking, are but forms by

which something is regulated: but as here there is nothing found in the hypothesis which appears to regulate these vital laws, and nothing vital to be regulated by them, with a strange inconsistency these laws are considered as animated beings putting their own regulations in force. In this character it is hard to perceive any difference between them and the old personified vires or dynamies. In short, the supporters of this opinion, instead of succeeding in their attempts to exclude entirely a vital principle, have inadvertently admitted a number; and instead of advancing any thing new, as they probably supposed, have certainly revived one of the most rude and antiquated notions in all physiology, though strangely disfigured by the difference of language in which it is expressed.

As the vital principle is acknowledged to possess but limited powers; as the exercise of its powers is also limited by the nature of the organs, and the exercise of the organs by varieties of circumstances; as the organs themselves are all composed of the particles of food, and these particles but partially subjected to the vital influence—we can hardly imagine that such a principle would ever be able either to construct or preserve its system totally independent of external causes. To maintain, therefore, a regular intercourse with external causes, that may serve it as auxiliaries, and to avoid or repel those that are inimical to its operations.

all its organs are found to be endowed with that kind or degree of irritability by which they are each peculiarly suited to their respective offices, and to the stimulants intended to act upon them.

These irritabilities, which are modified by the state and nature of the organs, seem partly to depend on the regular exercise of the vital powers, and partly on the kinds of external causes that co-operate as auxiliaries: They depend chiefly on the vital influence in all living bodies that are found to possess a heart and a brain; the heart by means of an artery and its branches, and the brain by means of its crura and nerves, diffusing this influence through every organ that is near or remote: They depend less on this kind of influence where the size of the brain, or the brain and the force of the heart, are but small; as in all those animals where the temperature is low, and the circulation comparatively languid: They depend still less on this kind of influence where a heart and a brain appear to be wanting, and the duty is left merely to an artery, a spinal marrow, and their respective branches: Least of all on this kind of influence where nerves and arteries vanish from the sight, and where all nourishment is conveyed by absorbents opening from the surface; by an inverse ratio, in all these cases they depend on external or auxiliary causes.

As for their continuance after the causes have ceased to operate, that must be inversely as the

constancy and extent of their dependency on the operations by which they were supported, or directly as the permanency of the general consequences of these operations; and as for their continuance in a separated organ, that must be inversely as the constancy and extent of their dependency on the vital principle and those auxiliaries that have ceased to operate, and directly as the influence of those auxiliaries that continue to operate.

Separated organs, when they have retained their irritability a considerable time, have sometimes again been united to the system, sometimes to the part from which they were taken, sometimes even to a different part, and sometimes even to a different system, where the parts were congenial. In a Latin thesis, entitled *De Anima, seu Principio Vitali*, which I published at Edinburgh in 1796, I had hastily concluded from these phenomena, and from some others that are usually exhibited by certain species of polypi and plants, that the vital principle itself was divided: It now appears, on more considerate and extensive inquiry, that irritability is never the direct or immediate operation of the vital principle, but only the consequence of its operation; and in no case exclusively the consequence, but the consequence likewise of other operations proceeding from a number of different causes: and hence it is, that a vital principle may often exist where it cannot operate, in a sensible

manner, from the want of auxiliaries; and hence it is, likewise, that its effects may often be continued, at least for a while, after its departure.

With regard to the portions of plants and polypi that continue to live in a separated state, assume the form of their respective species, and propagate their kind, they will be found, on a close examination, to have been originally complete systems; many of the plants, and many of the polypi, that are usually considered as simple individuals, not constituting one animated system, but rather a congeries of animated systems—a congeries, too, which after all is nothing more than a species of society, where animated beings are associated together for mutual protection; such as we see among men in a city, among bees in their cells, or among insects that construct habitations, which, in point of form, are similar to plants.

From the irritability of the several organs, the functions are always partly regulated by external causes. It is therefore we see the instincts of animals, and more than the outward appearance of plants, varying with the change of season and circumstance, that seem to exert an influence from without inversely as the influence of the vital principle, which operates from within. What here has particularly been matter of surprise is, that on all the organs of animals, the organs of sense not even excepted, impressions should be made, and considerable changes, local and general, induced on the

functions, long before there is the most distant intimation or consciousness of what has taken place. The insensible changes made upon the organs would seem to be at first insensibly communicated to the vital principle, from the vital principle insensibly communicated back to the organs, till, gradually increasing by the continued and alternate recoil, strong emotions at last are excited, consciousness roused, and the voluntary powers brought into action, with a change of place, attitude, or conduct, suited to the newly induced disposition. It is thus we see ends frequently obtained, and the interests of the animal and species promoted, in a way that indicates superior design, intelligence, and foresight; but a design, intelligence, and foresight, in which the judgment and reflection of the animal never were concerned; and which, therefore, with Virgil, and with other studious observers of nature, we must ascribe to the Sovereign of the universe, in whom we live, move, and have being.

Other processes equally obscure, equally wonderful, and equally important, though more familiar from their daily occurrence in the animal system, appear to commence in the organs themselves; and, like the preceding, awaken consciousness only at the periods when they happen to require the necessary aid of the voluntary powers in allaying thirst, hunger, or desire; in procuring sleep:

or expelling from the system what is useless and hurtful.

Even plants themselves are so wonderfully regulated by external causes, that, in many instances, they seem to be no less acute than animals in discerning the nature of seasons and circumstances; and hence may be the reason that some philosophers, from not considering the kinds of phenomena which they exhibit, or the manner in which these phenomena are produced, have bestowed on them sense, penetration, and feeling, superior to any thing that man can boast of.

The appropriate impressions made on the senses, and which are followed almost instantaneously, not only by consciousness, but distinct perception, might, one should imagine, with the size of the organs and obviousness of structure, assist in explaining how the less sensible and obscure impressions reach the sensorium; from what sort of causes they proceed, and by what modification of organs they are afterwards conveyed. But, unfortunately, here the organs of sense afford us but few means of information; and though they may sometimes flatter us with hopes on beginning our inquiries, yet they soon present to us mysteries as inscrutable as any to be found in the system.

Even the voluntary functions themselves, the very functions that seem to depend on our own choice, that seem to follow as the consequences of our own previous intentions; even these very func-

tions are in many respects fully as inexplicable as the involuntary; the functions over which we have no controul, and concerning a great many of which we have not even the least information by feeling, by consciousness, or the processes of reasoning. A man cannot move his tongue or his finger; he cannot so much as even make a sign that he really has within him a few inconsiderable particles of knowledge, without employing at that very moment a variety of means of which he is grossly and deplorably ignorant, and must ever be ignorant to the last pulsation that vibrates in his heart.

In our voluntary actions, there is no reasoning, no selection, as to the necessary branches of nerves, the courses which they take, or the places in which they originate and terminate; no calculation as to the nature or quantity of the energy that is to be communicated; no kind of thought as to the changes that may happen to be necessary in the action of the veins, arteries, absorbents, the quantity, quality, or momentum of their fluids; no reasoning as to the parts that ought to be steady while the others are in motion; no reasoning as to the muscles, or the parts of the muscles, to be principally employed; as to the muscles that must needs co-operate; or as to the force, the velocity, the extent, and the order of succession with which they are to act. We have only to will, and our purpose is accomplished: accomplished, indeed, in a way that

we know not, but accomplished in a way which human intelligence could never have devised, and which human ingenuity could never have directed.

CHAP. III.

ON MUSCULAR ACTION.

Of the ultimate fibres composing a muscle; of their connection with contiguous fibres; of their form, their structure, and that series of processes occasioning their contraction, much has been said, conjectured, and reasoned; but nothing of importance added to our stock of authentic information. Chemistry indeed has been able to inform us, that when they are freed, as much as they can be, from the substance of veins, arteries, absorbents; from that of cellular membrane and nerves, they, as dead matter, resemble in their properties the coagulable lymph; and yield, among other chemical products, a very large proportion of azote. The intelligence, however, affords no idea of what were the effects of their organization, their form, situation, connection, and action, when they were in the system. To apply to chemistry for an

explanation of these phenomena, would be almost as wise as to break in pieces the tools of an artist to discover his genius, and to ascertain the nature, extent, and variety of his labours. Whatever may depend on the kind of the particles composing an organ, the vital phenomena must depend more on those proportions, and on those specific forms and arrangements, which are peculiar to the animated system; and still more on the agent that produced them, preserves, and employs them, as well as on the circumstances in which it operates. From the preceding general observations it must be evident, that vital phenomena are modified by many varieties of causes; and though sometimes ambition, ardour, and confidence, may find it easy to persuade our ignorance, that nothing can escape her penetrating eye, and that causes, should they operate never so secretly, must always be detected by what she chooses to denominate *experiments*; yet the prudent and cautious will be slow in believing, and must often, on stricter inquiry, perceive, that while many fanciful causes are adduced, many of the real are openly excluded, many overlooked, and many never seen, through the medium of hypothesis. While saying to ourselves that Nature operates in the simplest way, and that our hypothesis is the simplest that can be, let us not suppose that she therefore will adopt it. We have many, indeed, and irrefragable proofs, that her simplicity is not the simplicity of conceited mortals,

who can trace their knowledge to the impressions made upon their senses, with as singular a simplicity as if they were to trace the contrivance of a building to the rude materials out of which it was formed, or to the carriages by which they were conveyed; and then view the discovery as a proof of deep philosophical research, sufficient to perpetuate their memory for ages.

If anxious to know the muscular functions, or any of the functions of the animal system, even but imperfectly, we must not begin, like the metaphysicians, by examining the phenomena of the vital principle with little or no reference to its organs; nor, like some physiologists, by examining the organs and their irritabilities without any reference to the vital principle; nor, like some chemists, by examining the substances of which organs are composed with but little regard to the vital principle, to the irritabilities, or to the mechanical effects of arrangement: we must rather begin by taking views that are less circumscribed, proceed with that patient and laborious inquiry that was not despised, excepting in trifles, by Bacon, by Newton, by Harvey, and Linnæus. We must, like them, carefully mark and duly consider every distinction and every analogy, but fancy none. In short, we must begin by examining the system alive and operating; operating, too, at different times, in different circumstances, and in different individuals; must afterwards examine its structure

minutely in the dead state; recur from the dead back to the living, and from the living back to the dead, alternately consulting the one and the other for additional information concerning the relations between functions and organs; an information which we always shall need, though in many of our difficulties we never shall attain.

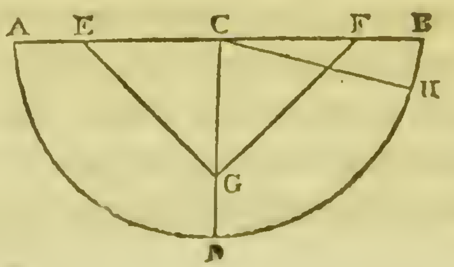
It was to prevent contracted, hasty, and fanciful views of the animal economy, and particularly of the nature of the muscular structure, that the previous observations were deemed necessary. As such views render all the experiments, and all the reasonings that are founded upon them, but unprofitable labour, we cannot be too anxious to avoid them; and therefore, to prevent as much as we can any misconception of muscular action, it may not be improper, before we enter on particular descriptions, to add likewise some remarks on the muscular fasciculi, and on the manner in which muscles in general either change or fix the attitudes of the system.

The smallest fasciculi which we can distinguish by the naked eye are denominated *fibres*, with sometimes the epithets *carneous* or *tendinous* to mark out the species to which they belong. These fibres, composed of the fibres that are termed *ultimate*, are seldom seen extending from the one extremity of a muscle to the other: the length of a muscle depending upon the succession of fibres united laterally by vessels and nerves, and by cellular

membrane; and the breadth and thickness of any particular part of a muscle, on the number of fibres laterally connected. It is hence that fibres, during their contraction, run into waved or zigzag lines; and that a muscle is frequently observed to have different forms and different dimensions in different places.

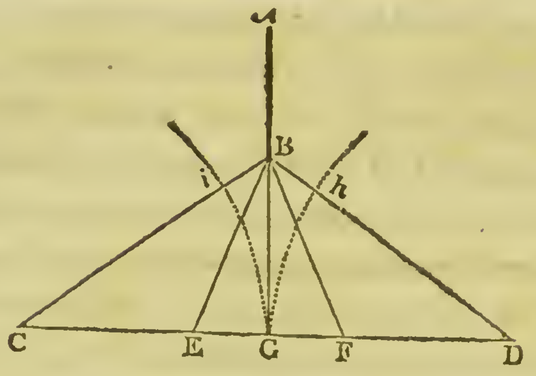
All carneous fibres concerned in the movements or attitudes of the skeleton are attached to bone, to periosteum, or both, either directly or indirectly; if indirectly, through the medium of tendon, through the medium of other carneous fibres, through the medium of carneous fibres and tendons, or the medium of cartilages.

Carneous fibres, continued by a straight line into tendon, shorten the muscle to the same extent that they shorten themselves; carneous fibres that enter obliquely shorten it more, and still more in proportion to their degree of contraction as they deviate farther from the line of the tendon, and approach nearer to the perpendicular; the perpendicular direction being that in which the fibres would shorten it most with the least contraction.



Suppose that AB represents a tendon, and CD a carneous fibre; that AB is the diameter, and CD the semidiameter of the same circle. It must be evident, that if CD were to contract so as to bring the point C to the point G, the two moveable extremities of the tendon would be respectively at E and F, and the situation of the tendon itself be represented by the two lines EG and GF; or if the fibre were to contract so as to bring the point C to the point D, the extremities of the tendon would then be in contact, though the distance between them had been formerly double the length of the fibre. If the fibre CH, on the other hand, were to contract so as to bring the point C to the point H, the point A would be drawn but a little beyond the centre, and the distance between the extremities of the tendon diminished but by little more than a half, and only a half if CH had lain in contact parallel to CB.

When two fibres enter a tendon upon opposite sides, and happen to contract at the asme time, they will draw the tendon in the diagonal; and the nearer that the angles which they form with the tendon approach to right angles, the more will they shorten the length of the muscle in proportion to their degree of contraction.

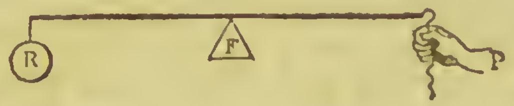


Suppose AB the tendon of a muscle, and CB, DB, EB, FB, GB, carneous fibres inserted at B; suppose, too, that all these fibres are made to cooperate in bringing the point B to the point G: the length of the fibre GB, continued by a straight line into the tendon, will be exhausted when the point B is brought into contact with the point G; the oblique fibres EB and FB will retain respectively only the lengths between EG and GF; while the two other oblique fibres, that entered more nearly at right angles, will still have the respective lengths of CG and DG, less than their original lengths only by the distances between *h* B and *i* B.

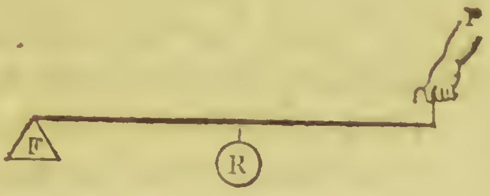
All muscles belonging to the skeleton are furnished with levers; and wherever there is a lever, there is also a fulcrum, a power, and a resistance, which, in different cases, may be differently situated with respect to one another.

When the head is moved backwards and forwards upon the first of the cervical vertebræ, the

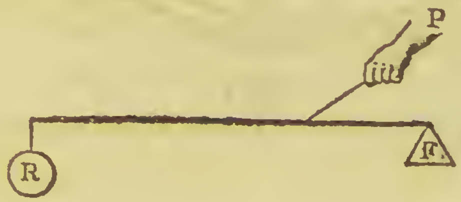
fulcrum then is situated between the power and the resistance, which are respectively iniad and antiniad of the centre of motion.



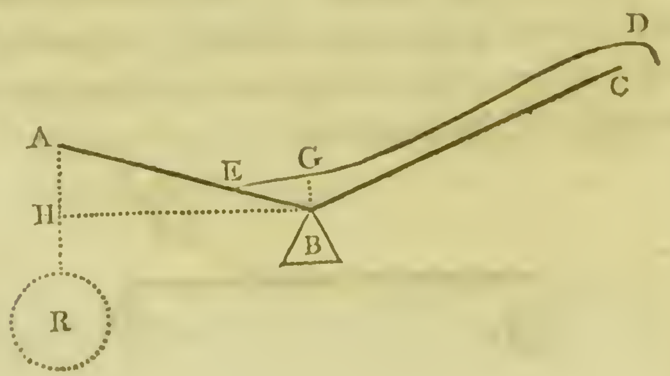
When the tibia rests upon the astragalus, and the heel is raised by the tendo Achillis, the pressure of the tibia, which happens to be the resistance at the time, is situated between the power and the fulcrum, which are respectively at the heel and the toes.



In raising a weight at the palm of the hand, and bending the arm at the joint of the elbow, the power affecting the joint of the elbow is then between the resistance and fulcrum, respectively situated at the palm of the hand, and at the distal extremity of the humerus.



Every lever is a sort of balance; and the parts of the balance, extending from the fulcrum or centre of motion to the points on which the power and resistance operate, are respectively the levers of the power and the resistance: But as those who have treated of the nature of dynamics have clearly demonstrated that the influence of these levers is not to be estimated by their actual lengths, but by straight lines drawn from the fulcrum or centre of motion perpendicular to the planes in which the power and resistance are acting, it must follow, that the distances between the power, the fulcrum, and resistance, in the course of the bone, are not the distances by which we are to estimate the influence of the levers. For these reasons, in speaking of the levers, of the power, or the resistance, we must be understood as speaking of only their efficient levers, or the levers coinciding and commensurate with the lines drawn from the fulcrum or centre of motion perpendicular to the planes of the power and the resistance. To illustrate this by the help of a figure:

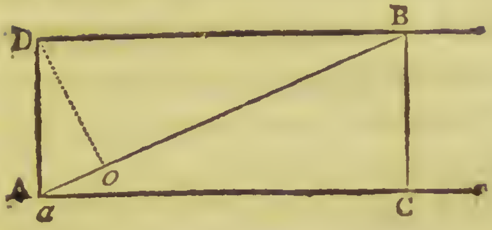


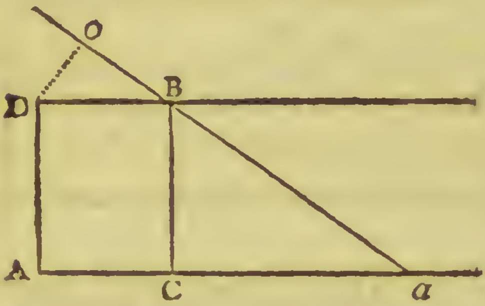
Suppose AB represents the radius, BC the humerus; that DGE is the biceps muscle; that the apex of the triangle is the centre of motion at the bend of the elbow, and R the resistance appended to the distal extremity of the radius: the lever of the muscle will not be BE but BG, and the lever of resistance not BA but BH.

Here the plane of the muscle, as is generally the case, being situated nearer the centre of motion than the plane of the resistance, it follows that a muscle, by a small and slow contraction of its fibres, may produce an extensive and rapid motion at the place of the resistance, and produce that motion with but little change in the relative situation of itself or its fibres; with but little change in the symmetry or form of the parts that are affected; and but little alteration or impediment of function of the nerves, the vessels, or cellular membrane. It is true, that from the shortness of the muscular lever there must be a waste or expenditure of power, as the muscle, in consequence of such a lever, must exert a force by many times greater than that of the resistance which it has to overcome: but it should be remembered that the force of a muscle depends not merely on the length of its lever or the number of its fibres; it depends principally on the vital energy, which an act of the will, in ordinary cases, can increase or diminish according to the nature of the effort required.

From all muscles, *cæteris paribus*, producing a greater extent of motion by a less proportional degree of contraction, and, consequently, a less proportional change in themselves or their fibres, than if they were shorter, the muscles that follow a direct course are seldom attached at the nearest points of the two bones with which they are connected. By this contrivance, beside the advantages already mentioned, relations are formed between parts at a distance, and the mutual dependence of the functions and organs extended and strengthened.

On the other hand, the muscles that stretch not on the surface of the bones to which they are attached, are observed to follow an oblique direction; and by this direction acquire not only contractility and length, but at the same time a shorter lever than if they had been inserted at the same place with a less obliquity.

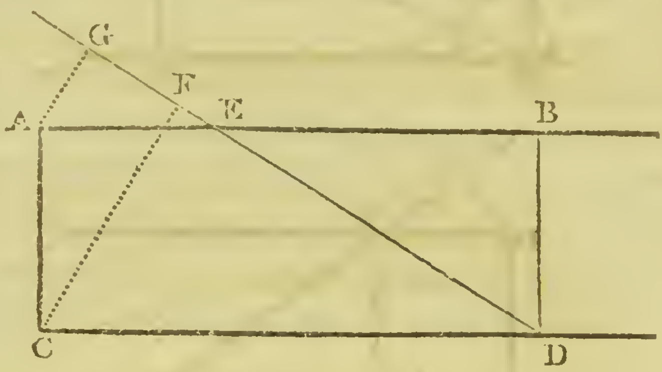




Suppose that DA represents a part of the vertebral column; that DB and AC are parts of two ribs that happen to be parallel, the latter fixed, and the former moveable on the centre D; suppose, again, that *a*B and BC are two muscles, the one observing an oblique course, and the other a direct one: the lever of the first, which is DO, is obviously shorter than the lever of the second, which is DB, the hypothenuse of the right angled triangle DOB.

If muscles be attached to ribs that are parallel, equally moveable, and at right angles to the vertebral column, those that follow the direct course from the one to the other will act by equal levers upon each, and make them approach through the middle space with the same velocity; but those

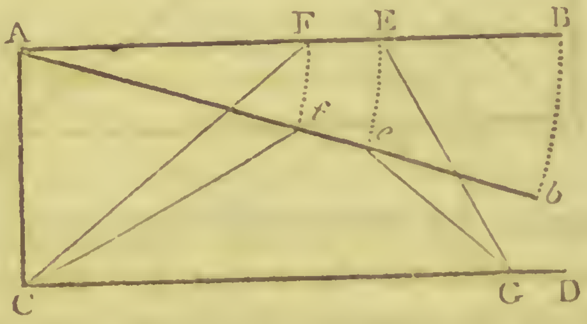
that observe an oblique course will act by different levers upon each, and make them approach with different velocities.



Suppose that AB and CD are parallel ribs, equally moveable at their vertebral extremities A and C; that DB and DE are two muscles, the one observing a direct course, and the other an oblique one: the levers of DB will be AB and CD, which, from AC being parallel to BD, must necessarily be equal to one another; the levers, again, of DE will be CF and AG, which being levers of different lengths, the muscle must act with different forces on the different ribs, making CD, on which it acts by the longest lever, approach faster to AB than AB to CD.

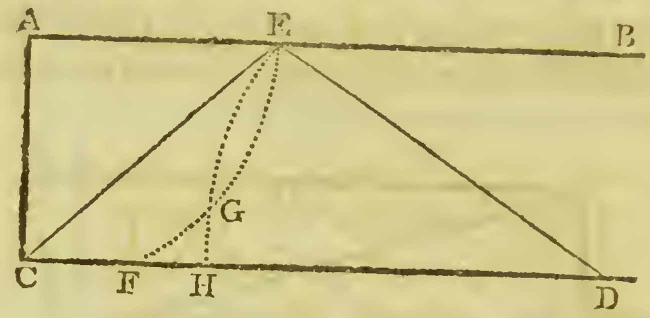
Where bones are not parallel, the muscles that cross in the interstice between them must fall obliquely on the one or the other; it being impossible for a straight line to fall perpendicularly on other two lines unless they be parallel.

As all bones move on a centre, or axis of motion, and the muscular attachments in a circumference, the muscles, in changing the relative position of any two bones, must at the same time, through their tendons or otherwise, be changing the direction of their own action, and varying their lever.



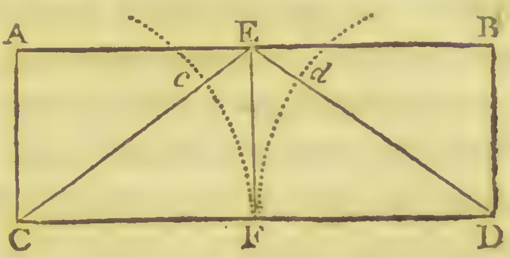
Suppose AB and CD the parts of two ribs, and AB moveable on the centre A; suppose, too, that AB is brought by the muscles CF and G*e* to the situation A*b*: the points of muscular attachment will be *f* and *e*, and the muscles will be C*f* and G*e*, with a change of length, situation, inclination, and lever.

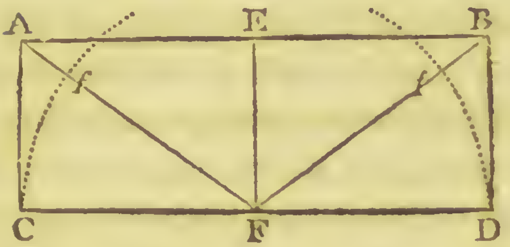
All muscles, where the points of attachment move in a circle, draw towards the centre, or towards the circumference.



Suppose AB and CD two ribs; CD fixed, and AB moveable on the centre A. The point E, drawn by the muscles CE and DE, will move in the circumference EGF; CE drawing centrad, or towards the centre; and DE drawing peripherad, or towards the circumference, and shortening itself only till it come to G; as may be shown by making the point D the centre of a circle, and describing, with the radius DE, the segment EGH.

If any two bones, by the action of their muscles, could be made to approach like the two sides of a parallelogram, the oblique muscles attached to their parallel and approximating surfaces would perform a greater extent of motion, and with a less decurtation of fibres, than any straight muscles whatever attached to the same parallel surfaces.

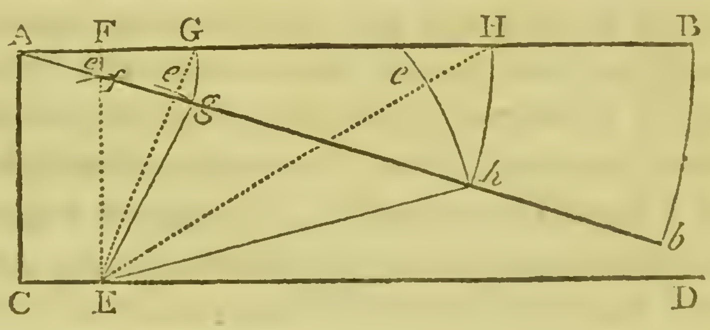




Suppose AB and CD to be parts of two ribs that are parallel, and that shall continue parallel till AB be brought into contact with CD by the straight muscles AC, EF, and BD, and by the oblique muscles CE and DE in one of the figures, and FA and FB in the other. It must be evident, that when the point E is in contact with the point F, the lengths of the straight muscles must be exhausted, while the oblique muscles will still retain the respective lengths of CF and FD, less than their original lengths only by the distances between *c* E and *d* E in one of the figures, and A *f* and B *f* in the other.

But as no two bones can approach one another like the two sides of a parallelologram, at least by the action of a single muscle; and as no muscle

can continue to act perpendicular to their two approximating surfaces, a muscle entering them at right angles when they are parallel may be placed so near to the centre of motion as to carry the bones through a given space, and with a less decurtation of fibres than any oblique muscle whatever of the same origin, but inserted at a distance, and acting through the medium of a longer lever; and, further, a muscle with a less obliquity may also be situated in such a manner as to carry the bones through a given space, and with a less decurtation of fibres than any other muscle of the same origin, but of a much greater obliquity.



Suppose AB and CD two ribs, and AB moveable on the centre A; suppose, too, that AB is brought, by the decurtation of the straight muscle EF, and the two oblique muscles EG and EH, to the situation A *b*: the points of attachment, after moving in the segments F *f*, G *g*, H *h*, will now be respectively at *f*, *g*, *h*. On the centre E describe, with the radii E *f*, E *g*, and E *h*, the seg-

ments of three different circles: the difference between the present and former lengths of the most oblique muscle will be *e* H, while the differences between the present and former lengths of EF and EG will be only *e* F and *e* G.

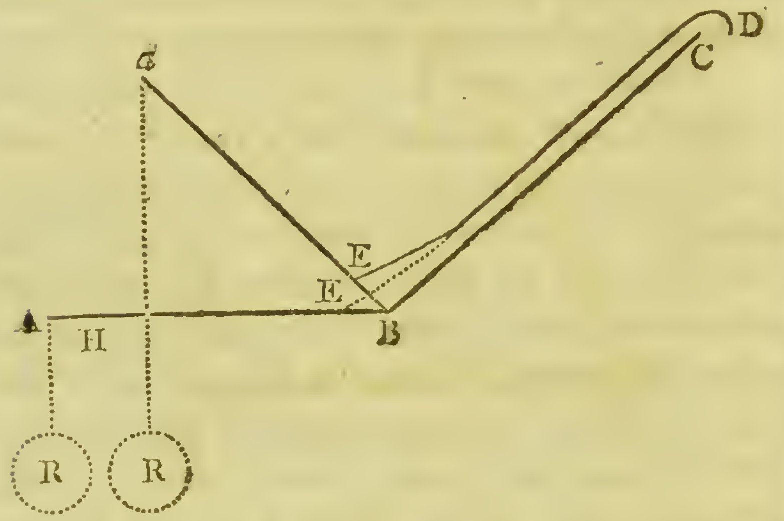
The decurtations which any muscle suffers in carrying round the point of its attachment through a given space, will partly depend on the length of its lever, partly upon its degree of obliquity, partly on its drawing peripherad or centrad, and partly on its acting without or with a pulley.

The lever of a muscle which is varied with every degree of obliquity, is varied likewise by every change in the centre of motion. Where bones are connected by large surfaces, the centre of motion frequently shifts from one part of the surface to another. Thus, in the motion of the tibia and femur upon one another, the centre of motion advances to the rotular aspect during extension, and to the popliteal during flexion. Hence the muscle that contracts often loses at once a part of its contractility and lever, while its antagonist is acquiring at the time an increase of both; a circumstance that enables the antagonist muscle to act with a greater force and velocity in restoring the parts to their former situation.

The centre of motion generally approaches towards that aspect whither the bone is moving at the

time; and as it advances, the muscles recede, to increase their force—and to every observer recede most obviously in the vigorous flexions of the elbow and knee joints.

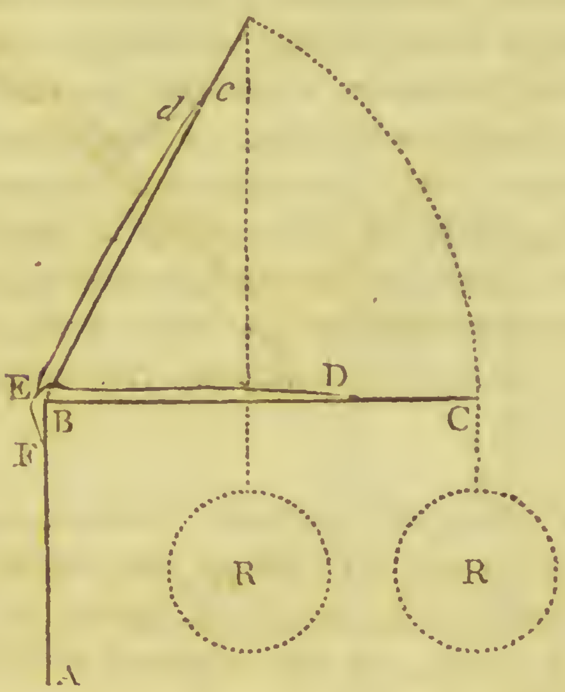
The lever of resistance, as well as of the power, is varied by the several changes of position; is sometimes shortened at the time that the lever of the power is lengthened; and, *vice versa*, lengthened as the lever of the power is shortened.



Suppose AB represents the radius, BC the humerus, DE the biceps muscle, and R the resistance appended to the distal extremity of the radius. When BA is brought by the biceps into the situation B*a*, the lever of resistance will be no longer BA, but BH, equal to a straight line drawn from B, the centre of motion, perpendicular to the plane of the resistance. It is evident

from the figure, that as the lever of resistance has been shortened, the lever of the muscle has been lengthened; and that, were the radius to assume again its former situation, the lever of resistance would again be lengthened, and the lever of the muscle again shortened.

Sometimes, again, the lever of the power and of the resistance are lengthened and shortened at the same time.



Suppose AB represents the tibia, BC the femur, and DEF the crureus muscle; and that the femur, with the weight of the body, is to be raised to the situation B *c*: the centre of motion will, du-

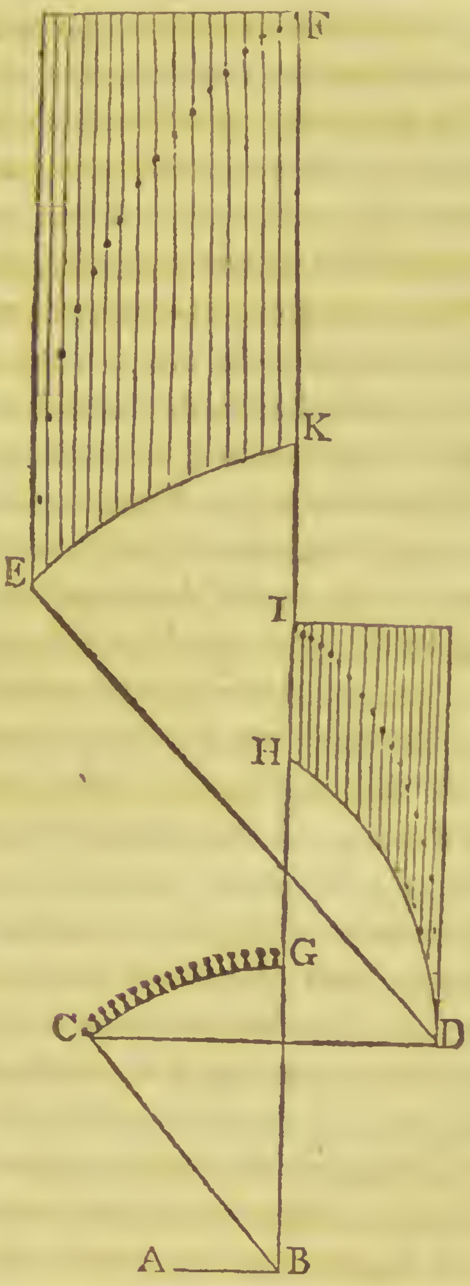
ring extension, approach towards the muscle at the rotular aspect, while the plane of resistance, as is evident from the figure, will be approaching to the centre of motion.

But, though this figure be calculated to show how the levers of the power and of the resistance may be lengthened or shortened at the same time, it is by no means intended to illustrate how, in the motions of the living body, the femur is brought from the horizontal to the erect position. In rising from a chair, the centre of gravity must fall within the base upon which we are supported; and therefore this centre, by the inclination of the body or otherwise, must be brought to the base, the base brought to the centre of gravity, or both made to meet by mutual approach. It is hence, that in rising from a chair or a sopha, where the femur and tibia were at right angles, the feet are drawn back, or the body thrown forward, before we can assume the erect posture.

In the changes of attitude, while a bone is turning on its centre of motion, the centre itself is often at the time describing either the segment of a circle, or a line composed of the segments of circles.

Suppose AB represents the foot, BC the tibia, CD the femur, and DE the trunk, and that the three last are to be brought by the action of their

muscles to the perpendicular BF, so that BC shall



occupy the situation of BG, CD the situation of

GI, and DE the situation of IF; the point C on the centre B will move in the segment CG, and as C is changing its position in CG, the point D, which moves round the point C as its centre, will, if the extensions be regularly performed in the same time, describe such a curve as DI: for, as the point D must necessarily move atlantad and sternad, in order to preserve the centre of gravity, the general direction of its course must be known; and if CG be divided into equal parts, and at each of the divisions a circle described with the radius CD, the points in DI, corresponding in number with the points in CG, and at equal distances in the sternal direction, will each be found in the circumference of one of the circles described successively round the point C as it passes along the segment CG.

In like manner, if the extensions of CD and DE be regularly performed in the same time, the point E will describe such a curve as EF, the points in EF being in the circumferences of the several circles successively described round the point D as it moves along the curve DI.

The figure is also calculated to show how the rapid extension of the several joints may carry the body directly upwards; the motions are alternately dorsad and sternad, and all of them atlantad: if the motions, therefore, dorsad and sternad, be made exactly to balance their forces, the motions atlantad only will remain, and carry the body directly upwards; on the other hand, if the respective motions sternad and dorsad be unequal in force, the

body, at the time that it moves atlantad, will likewise move either sternad or dorsad.

That these illustrations by the help of the figure might be less complex, the vertebral column is supposed for the while to continue inflexible, and by its extension on the point D to be capable of forming a straight line with the femur and tibia; on this supposition, if a force were applied to the point F it would press directly through the medium of the trunk on the femur and tibia to the point B. But as the supposition is without any foundation in nature, and as no two bones are ever known to form straight lines, or to be united by parallel surfaces of articulation, the pressure which one bone makes upon another must always be oblique, which causes them to turn on their centres of motion, and as their centres of motion are moveable, to diffuse the pressure generally and suddenly through the whole system, and thus counteract with admirable contrivance the dangers of concussion.

To prevent any unnecessary trouble in trying to ascertain the nature of the curves which bones describe round moveable centres, it may here be observed, that the curves DI and EF are merely the curves which bones describe in particular circumstances; and that with the assistance of moveable centres the bones may be made, if properly directed, to describe any species of line whatever, as must be evident from the motions of the hand, that can be made to follow any line, whether straight or curved, that can possibly be drawn.

In these changes it is scarcely necessary almost to remark, that where any balancing of the body is required, the flexions and extensions must be always accommodated to the centre of gravity, or the centre of gravity to the flexions and extensions. The variety of modes, the prompt celerity, and the wonderful exactness with which these accommodations are effected, are not among the least singular phenomena of the animal economy, and are often found, amid the changes of attitude and place, to characterise not only the individual, but the species. That length of neck which is necessary to a great number of animals in procuring their food, is regularly employed by the same animals in balancing their system: and even the most careless observer may have seen that birds employ it in changing the centre of gravity from their legs towards their wings, or from their wings towards their legs, according as they choose to walk or to fly.

Should it be asked, how, amid the changes in the lengths of lever, and the varying degrees of contractile power in the different muscles, any general motion should be continued with the same force, velocity, and steadiness from its commencement to its termination? it may be replied, that the vital principle, to a certain extent, can regulate its energy according to circumstances; that no change of attitude or place is ever produced in the osseous structure of the human body merely by the action of a single muscle; that while one muscle is gradually losing a part of its lever, another muscle con-

cerned in the motion is often at the time receiving an addition to its length of lever; or, in short, that the bone, in passing beyond the sphere of action that is destined for one muscle, is often entering the sphere of action that is destined for another, and the motion continued without any change of velocity or force. This consequence is partly the effect of a difference of length, contractility, and position in the muscles that co-operate, and partly the effect of some other causes. Some muscles pass over one joint, some again over two or more, while the muscles that pass over most joints are, in every region where they are situated, necessarily also the most superficial. In the neck and trunk, those that pass over several joints are flexors or extensors, according as they bring the parts of their insertion to the perpendicular, or carry them beyond it. In the extremities some of them are flexors, some of them extensors, and some of them, again, flexors of one joint and extensors of another; while in all cases where the joint admits of a rotatory motion, they are also rotators. From this connection with a number of joints, it must be evident that any change of position in one of them must more or less affect the action of the muscles on the rest. Thus, when the carpus is very much bent, the *Extensor communis digitorum manus* is considerably stretched, its lever and contractility augmented, the complete exion of the fingers prevented, and the power of

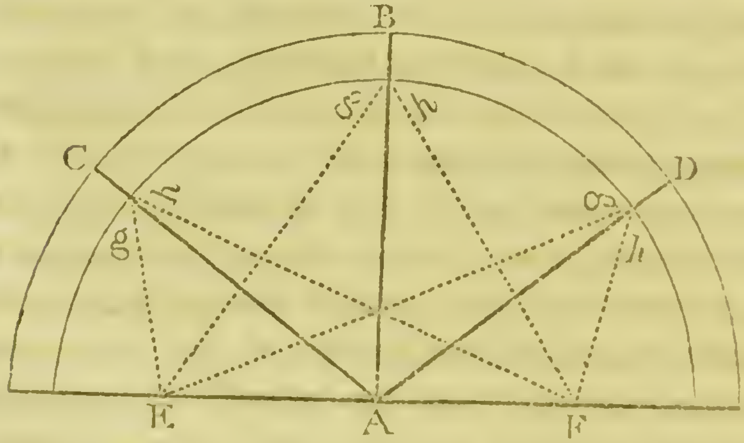
extending them obviously increased; and thus, too, when the femur is brought to a state of flexion, are the *semitendinosus*, the *semimembranosus*, and the long head of the *biceps cruris*, stretched by the hip-joint, and enabled to act with the greater energy on the joint of the knee, or, if the joint of the knee be extended, with greater energy on the joint at the hip. The most singular effect, however, of the joints on the action of the muscles, is what we observe in the legs of those birds that perch during sleep. The flexor of their toes is an extensor of the joint at their heel, and attached in such a manner that the flexion at the heel is necessarily followed by a flexion of the toes. Whence the toes, merely from the attitude assumed, and without any kind of voluntary effort, are made to lay as firm a hold of the branches while the animals are asleep as while they are awake; a circumstance noticed and explained long ago in the celebrated work "De Motu Animalium."

The long muscles seem principally intended to preserve a connection between the functions of the several joints over which they pass. Thus, were any of the joints of the vertebral column either to be bent or extended singly by short muscles, and the parts in motion to pass through many degrees of a circle, the spine itself and the spinal marrow would be constantly in danger from the quantity of motion, and from the extensive change of position in the parts affected; and

were any of the large joints of the extremities to be bent or extended without any change whatever upon others, the balance of the body would be often overturned, and our intentions in voluntary motions rendered ineffectual. To change, therefore, and to fix the attitudes with steadiness and accuracy, not only is it necessary that the lengths, forms, and positions of the muscles, but that all the various forms of the joints, should be mutually accommodated to one another; and hence it is, that the functions of the joints are not only closely and accurately connected, but all the joints so adapted to the muscles, and all the muscles so adapted to the joints, that amidst some millions of possible relations which they might have had, the particular relations which they actually have are the only relations, so far as we can judge, that could have rendered them fit to co-operate, or rendered them subservient to the influence of the will; and yet these relations, numerous, and minute, and intricate as they are, are, so far as essential, regularly preserved from birth to maturity; for as the bones grow in size and in strength, so grow the muscles, their carneous fibres, their tendinous fibres, their veins, their arteries, their cellular membrane, absorbents, and nerves: so that, free from disease, and free from the natural infirmities of age, the voluntary muscles, when properly directed, are capable of performing their functions with steadiness in all the different periods of life. Nor let this view deter us from the patient study of

the muscular system; the joints, the bones, and the muscles themselves, are easily remembered: and it seems to be here, as in all other cases where the author of nature chooses to employ secondary causes, the separate agents, in number, are but few; and that immense variety of effect, by which they astonish every observer, does not so much arise from their number as from the infinite variety of modes in which they are made to combine their operations.

On examining the structure of the animal system, we generally find, that the motions of the bones, as produced by the muscles, are the combined effects of different forces; and that hence a small number of muscles are enabled to produce with steadiness and accuracy an almost infinite variety of changes.



Suppose that AB is a bone moveable in two directions, and that Eg and Fh are two muscles; it must be evident, that by lengthening, and shor-

tening, and by varying their relative degrees of force, they may change its situation to AC, to AD, or to any given point in the circumference, and there arrest it by balancing their actions.

As for the correctness with which they are able to produce these effects, suppose the circumference to be twenty-four inches, that each of the inches is equally divided into twelve parts, and that the bone may be arrested at each of the divisions, which we know to be possible; with what accuracy must the muscles contract towards the centre, in order to regulate their extent of motion, with so much precision, towards the circumference! In producing the several musical notes, by changes on the small aperture of the glottis, or in balancing the body on the tight and slack ropes, we know that the muscles must contract with such minuteness and accuracy, as frequently to regulate their extent of decurtation by smaller measurements than the two hundred thousandth part of an inch.

But to return to the changes of position; suppose a bone susceptible of motion in no less than four general directions, and its motions regulated, not by four, but by six, eight, or by ten muscles, all of them capable of combining their actions, and all of them capable of varying the force, the extent, duration, and order of succession of these actions, whenever it is willed, their variety of effect must be almost incalculable; as we may see in changing the positions of the os hyoides, humerus, &c.

In the regulation, however, of these motions a smaller number of muscles than four can never be employed; and even these must be employed in different capacities to produce their effects with steadiness and accuracy. Let us take for example the motions of the head, the motions of the neck, or the vertebral column as far as the sacrum: these parts may be inflected in any given line of direction, *sternad*, *dorsad*, *dextrad*, or *sinistrad*. Suppose that they are to be inflected *sternad*; there must be muscles, not only to move them in the sternal direction, but also muscles to prevent inclination *dextrad* or *sinistrad*: and, as the parts may be moved again in the opposite direction, there must also be muscles to act as antagonists or moderators to those which carry the parts sternad. In every motion, therefore, of the head of the vertebral column, or of bones that can be moved in several directions, there must always be a number of muscles employed, some as *motors*, some as *directors*, some as *moderators*.

And yet still our intentions, in producing these motions, could seldom be executed with much precision, unless the parts by which the organs in motion are supported, and the parts whence the muscles derive their origin, were to be kept comparatively steady: it is hence that, in changing the positions or attitudes, a number of muscles not employed as motors, moderators, or directors, are employed as *fixors*.

Lastly, as all the motions that vary the position of the head, neck, trunk, and extremities, must likewise vary the centre of gravity, a number of muscles must be thrown into action merely on purpose to preserve the equilibrium, if a person be either sitting, or standing, or moving from one place to another: these muscles, if a name were necessary, might be called *librators*. In general, we are not conscious of their action, unless when a state of morbid sensibility happens to show a connection between them and the muscles employed in changing the positions; or unless, when happening to perform a motion which we did not intend, we are under the necessity of falling to the ground; or of all on a sudden changing the *librators* with a violent jerk of the whole system, and then we are surprised how muscles, so distant and of such a number, should be concerned in merely changing the position of a part.

It is from the general and prompt co-operation of the different muscles in harmonizing the *flexions* and *extensions*, the *fixations* and *librations* throughout the several parts of the system, from the yielding, yet steady flexibility of the joints, from the oblique apposition of their surfaces, from the angles, the curves, and the varied direction of the bones united by articulation, and from the elastic substances interposed, that the system is enabled to resist so successfully the violent concussions to

which it is exposed in running, leaping, in stopping suddenly, or in falling from a height. By these contrivances, under the direction of the vital principle, concentrated forces are so admirably and suddenly disposed and diffused throughout every part, that even the functions of the most delicate are, in ordinary cases, seldom impeded. To these, therefore, more than to the strength of the bones and the muscles, are we frequently indebted, in cases of concussion, for the safety of the viscera contained in the cranium, thorax, and abdomen; for the safety of the blood vessels, nerves, and absorbents; and even for the safety of the bones and the muscles. This must be obvious from the violent shocks to which men are exposed, from the want of *libration*, when they are intoxicated; from the violent jerks which we often receive in attempting suddenly to recover our balance; from the distortions of the joints and the bones in cases of rheumatism; from the great number of luxations and fractures arising from unequal action in the muscles, when not prepared to meet with the accident; and also from the practice of bending iron bars over the fore arm when the muscles are every way prepared for the resistance.

That the muscles may be always ready to act on the shortest notice upon every emergency, we have mentioned already that they always are endowed with an irritability, and always possess a certain quantity of the vital energy; for it must not be

forgotten that their relaxation, in cases where they are said to be relaxed, is still, comparatively, a state of energy, and is to be compared with some one or other of their former states, or with the state of other living muscles, and never with that state of relaxation which a muscle exhibits in the dead body.

Another circumstance, that adds considerably to their promptitude of action in changing the positions and in varying the diagonal, is their power of acting in different directions. And here let us take the muscles of the head, the neck, and the trunk by way of illustration.

As the skeleton is divisible into similar halves, and as all the muscles moving the head, the neck, and the trunk, are, with few exceptions, situated either on one side or other of the *mesial plane*, every muscle belonging to a pair, and affixed to the head, the neck, or the trunk, must, whatever may be its remaining functions, draw the parts to which it is attached either *dextrad* or *sinistrad*.

As all the surfaces of articulation between the bodies of the different vertebræ, between the occipital bone and the atlas, or the temporal bones and basilar maxilla, either traverse, or would, if extended, necessarily traverse the *mesial plane*, all the muscles that are calculated to affect these articulations must, between the opposite points of their attachment, be directly or obliquely pointed to the sacral and atlantal aspects; and consequently, be-

sides drawing the parts to which they are attached *dextrad* or *sinistrad*, must draw them likewise *atlantad* or *sacrad*.

And as all the muscles that run between the sacral and atlantal aspects generally observe a degree of obliquity between the sternal and the dorsal aspects, and are generally situated either sternad or dorsad of the centre of motion, besides drawing the parts to which they are attached atlantad or sacrad, dextrad or sinistrad, they must draw them also, if not otherwise prevented, either *sternad* or *dorsad*.

In many cases, especially in the sacral and atlantal extremities, the particular direction in which several muscles act upon the bones is regulated by trochlear ligaments or pulleys, by fasciæ or lateral muscular connections; while in all cases it ought to be remembered, that whatever be their course or lateral connections, no muscles, in producing the natural changes of position, produce any changes of which the joints are not previously susceptible from their mode of articulation and ligaments. The articulations, therefore, and ligaments become necessarily an object of attention with every myologist; they often assist him in ascertaining the modifications of the muscular functions, and they even serve to point out a function different from any that has yet been mentioned.

All articulations are surrounded with a certain species of ligament denominated *capsular*. This

species of ligament has a smooth surface on its central aspect. From this surface a fluid is secreted to lubricate the joints; and when this fluid is defective in quantity, either from the size of articular surface, or the frequency, vigour, and extent of motion, the capsular ligament, which does not permit any fluid to escape except by absorption, is in these cases always assisted by a mucous gland lodged within the cavity, and attached to one or other of the bones, which contribute by their motion to assist its action and augment its secretion. To the peripheral aspect of the capsule, the muscles, particularly at some of the joints, are attached in their passage: and it has been observed, that where this attachment is found to take place, the capsule is like cellular membrane condensed; and that where it is not observed to take place, is thickened or supported by ligaments from without. From these facts it seems to be evident, that the muscles are the principal security of the joints; and that the thickening of the capsular ligaments, and the presence of other accessory ligaments concerned with the joints, are substituted only where muscles are wanting, where they could not act, or where they would have occupied too much space. This opinion is confirmed by the strength and by the security which every joint derives from its muscles, and especially by the manner in which the scapulæ and trunk are

connected in a great variety of the lower animals, by muscles alone, without articular surface or ligament.

As for the two crucial ligaments within the knee joint, their office, in some respects, is peculiar; they allow the femur to roll *tibiad* or inward, but not *fibulad* or outward; and the reason is obvious—we can easily arrest the rotation *tibiad* by placing the other foot upon the ground; but if the crucial ligaments were wanting, we could not arrest the rotation *fibulad* without leaning against a support, or instantly falling.

As for the velocity with which muscles contract, it is, like their force, regulated by circumstances that fall not within the rules of calculation. It seems to be different in different muscles, though in all cases it partly depends upon the rapidity with which the stimulants succeed one another; and that rapidity, so far as the functions of the nerves are concerned, is increased by habit. If the celebrated Haller could distinctly articulate one thousand five hundred letters in the space of a minute, the changes induced in the state of the muscles during that period must, reckoning the contractions and the relaxations, have amounted at least to three thousand; and yet these changes are slow when compared to the changes induced in the muscles of a fly, where sometimes the wings are known to produce a sound as acute as that of

the most rapidly vibrating cords; and slow when compared to the motions that take place in drawing a straight line with the hand—a line composed entirely of points which belong to circumferences of as many circles; and where every point, of which there may be thousands in a second of time, implies a change in the centres of motion; a change not induced from any necessity of co-operation, but merely from the influence of habit and volition.

PART III.

CONTAINING

DIFFERENT ARRANGEMENTS OF THE MUSCLES, ACCORDING TO THE MOTIONS IN WHICH THEY CO-OPERATE; AND OCCASIONAL EXPLANATIONS ALSO OF THE MANNER IN WHICH THEY CO-OPERATE.

INTRODUCTION.

In treating of the several motions of the system, the least attention to consistency of arrangement must suggest the propriety of following nearly the same order that has been adopted in describing the regions and muscular attachments. The order, therefore, that is here pointed out, is to begin with the motions of the head, and then to proceed to those of the neck, trunk, and extremities; reserving till afterwards the motions of the parts not so obviously included under these titles.

CHAP. I.

OF THE MOTIONS OF THE HEAD.

The motions of the head are *common* or *proper*: The common, those in which it participates with the neck and trunk; and the proper, those which are performed on the first of the cervical vertebræ,

the atlas. In the proper motions the head is without any sensible rotation inclined,

Sternad,
Dorsad,
Dextrad,
Sinistrad,

or in some of the intermediate directions. In causing these changes all the muscles that are anywise concerned exert a force in the sacral direction; those which are *motors* drawing the points of their attachment sacrad, and consequently raising or moving atlantad the parts that are situated on the opposite side of the centre of motion *.

The muscles employed in performing these mo- may be divided into two classes; those which affect the articulation between the occipital bone and the atlas only, and those which, besides that articulation, are calculated also to affect others. Of this second class, some are attached to the basilar maxilla, and the rest attached to the bones of the cranium.

Of the first class, or of those which affect the articulation between the occipital bone and the atlas only, there are four pairs :

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* See lever first, p. 277.

On the sternal aspect.	*Directions of action*.*
Recti capitis interni minores†,	Sac. dor. laterad,
Recti capitis laterales†,	Sac. ster. mesiad.
On the dorsal aspect.	
Recti capitis postici minores†,	Sac. ster. mesiad.
Obliqui capitis superiores†,	Sac. ster. laterad.

As each of these pairs has one of their halves situated dextrad, and the other sinistrad, of the mesial plane, in exerting a force that is sternad or dorsad, they must at the same time exert a force that is dextrad or sinistrad. In conceiving, therefore, how the head is inclined simply sternad, simply dorsad, dextrad, or sinistrad, we cannot help seeing that it must move in the diagonals of forces that are sternal, of forces that are dorsal, dextral, or sinistral; that the lateral forces, dextral and sinistral, must act as directors to the sternal and dorsal; the sternal and dorsal, again, as directors to the dextral and sinistral; that the motor forces must be moderated by those of the opposite aspect, and the sacral forces, at the centre of motion, be resisted by the fulcrum‡: In all cases, the dorsal muscles,

* These directions are the directions of the muscular fibres from insertion to origin, or from the moveable to the fixed points; while the term sternad, substituted for dorsad, atlantad for sacrad, and mesiad for laterad, will express the course of the same fibres from origin to insertion, or from the fixed to the moveable points.

† Vide Os Occipitale, p. 170. ‡ See page 303, 304.

dextrad and sinistrad, being the motors in inflections dorsad; the sternal muscles, dextrad and sinistrad, the motor muscles in inflections sternad; and the lateral muscles, dorsad and sinistrad, necessarily co-operating in inflections laterad.

In conceiving how the head is made to move between any two of the principal aspects, we have only to reflect, that the muscles are capable of varying their forces; and that when they happen to vary their forces, they must necessarily likewise vary their diagonal; although it must always be carefully remembered, that what is meant by the diagonal in which any part of the system is moved, is the diagonal of the forces exerted on the points of attachment, not always coinciding with the diagonal of the carneous fibres, which, in many cases, are capable of exerting different forces in the same position, and which in others are observed to enter the tendons obliquely, while the tendons themselves have afterwards their course changed and directed by the action of ligaments. Another circumstance not to be forgotten is, that *motor* muscles, when they regulate the diagonal, are also *directors*, and very frequently the only directors that we have to look for.

From the course here of the dorsal pairs, of the *recti postici*, and *obliqui superiores*, one might at first be induced to imagine that they were intended for rotatory motions; but the nature of the joint hardly admits of that kind of motion in a sensible degree: and, besides, the course that is here observed by these

four muscles, is also the course that is best calculated, not only for the motions of flexion and extension, but for fixing the attitudes with steadiness and accuracy when the head is rolled, through the medium of the atlas, on the vertebra dentata.

As the joint between the os occipitis and atlas scarcely admits of rotatory motion, so the joint between the atlas and vertebra dentata, which is fitted both by its form and its muscles for rotatory motions, admits but sparingly of flexion and extension, owing to the length of the tooth-like process, its moderating ligaments, and the strong ligament that stretches across it on the dorsal aspect. If rotatory motions were to be admitted immediately sacrad and atlantad of the atlas, it is natural to think that they would be performed by the same muscles; for were they performed by muscles separate and independent, the head might occasionally be rolling one way, and the atlas another, at the same time, which never could take place without the most imminent danger of luxation; a danger, certainly, to which one or other, or both, of the joints would be constantly exposed. Now, instead of this, the Author of Nature has assigned rotation to one of the joints, excluding inclination; and inclination to the other, excluding rotation, and excluding it, not only by the mode of articulation, but by the direction and action of its muscles.

Of the second class of muscles, those attached to the basilar maxilla consist of five pairs.

On the sternal aspect.	*Directions of action.*	
Latissimi colli *,	Sac. dor. laterad.	
Biventres maxillæ *,	Sac. dor. laterad.	At. dor. laterad
Mylo-hyoidei *,	Sac. ster. mesiad †.	
Genio-hyoidei *,	Sac. dorsad †.	
Genio-hyglossi *,	Sac. dor. laterad †.	

These muscles, in opening the mouth, depress the maxilla with considerable force; and when the maxilla happens to be fixed by the *temporales*, the *masseteres* and the *pterygoidei* must exert their force indirectly on the head, and co-operate with the muscles that move the head and the neck sternad. In these cases, the *latissimi colli* act independently of the os hyoides; while the *biventres*, the *mylo-hyoidei* ‡, the *genio-hyoidei*, and *genio-hyoglossi* ‖,

* Vide Maxilla Basilaris, p. 176.

† Very little sacrad when the base of the maxilla is on a plane at right angles to the axis of the neck.

‡ All the fibres of these muscles are at one extremity attached to the maxilla; only a few of them originate directly from the os hyoides, the rest originate at the mesial line, *dermad* of the two *genio-hyoidei*, and seem to act on the *genio-hyoidei* as the lateral muscles of the abdomen act upon the recti, or as the carneous fibre on the tendon. P. 274. Besides depressing the basilar maxilla, and regulating the positions of the os hyoides, they co-operate with the sternal half of the *biventres*, and also with the two *latissimi colli*, in supporting the tongue, and all the basilar part of the mouth from the symphysis menti to the os hyoides.

‖ The fibres of these evidently radiate from the basilar maxilla to the tongue and os hyoides; those radiating to the os hy-

require the os hyoides to be fixed or drawn sacrad by the

Omo-hyoidei,
Sterno-hyoidei,
Thyro-hyoidei.

The *latissimi colli*, which, as muscular fasciæ, compress the glands, the nerves, the blood vessels, and the absorbents on the lateral parts of the face and neck, may, besides depressing the basilar maxilla, and bending the head in the sternal direction, occasionly act as rotatory muscles in moving the head dextrad and sinistrad on the vertebra dentata. From this office the remaining muscles, however, are excluded; as none of them extend over the joint on which the rotatory motions are performed, and as none of them can possibly move the parts to which they, directly or indirectly, must necessarily at the same time owe their fixed points.

As for the action of the *biventres*, these two muscles might depress the maxilla, were they even detached from the os hyoides; but without such attachment they could not possibly affect the head; for to move the head indirectly, through the medium of the basilar maxilla, the latter must be so fixed to the former as not to change its relative situation; in which case, the two *biventres* would necessarily originate and terminate in bones not suscep-

oides run nearly dorsad; those to the tongue, sacrad, atlantad, dorsad, and laterad.

tible of motion upon one another: and therefore, without producing any change in the relative position of the head and the maxilla, they could only compress the parts of the pharynx lying between the points of their attachments. But, supposing the *biventres* attached in their course to the os hyoides, as they actually are, and the basilar maxilla to move only along with the head; upon the contraction of the *biventres*, if the head and the os hyoides were so moveable, at the time, as to yield to their action, they must necessarily be drawn, the one to the other; the os hyoides, if the most moveable, towards the head; or the head, if most moveable, to the os hyoides: in which case, the head and the maxilla would be moved sternad on the first of the cervical vertebræ, the atlas.

The remaining muscles of the second class, and which are attached to the bones of the cranium, consist of seven pairs:

On the sternal aspect.	*Directions of action.*
Sterno-mastoidei *,	Sac. ster. mesiad.
Recti capitis int. majores †,	Sac. dor. laterad.
On the dorsal aspect.	
Pars trapeziorum †,	Sac. ster. laterad.
Splenii capitis †,	Sac. dor. mesiad.
Complexi †,	Sac. ster. laterad.
Recti capitis postici majores †,	Sac. ster. mesiad.
Trachelo-mastoidei *,	Sac. dor. mesiad.

* Vide Ossa Temporalia, p. 168.

† Vide Os Occipitale, p. 170.

In each aspect they are here arranged in the order of their strata, and may be observed, like the four pairs of the first class, to run alternately laterad and mesiad from the place of their insertion. In their general directions they are seen, however, like all other muscles where motions in various directions are required, to differ considerably as to obliquity; and by their decussations at various angles, not only to strengthen the connections of the bones, but to multiply the natural diagonals of their fibres. By this arrangement they combine their forces in such an infinite number of ways, and with such facility, that the parts which they move, are all moved, directed, and moderated, with but little change in the relative position of their muscular fibres, and yet, at the same time, with a rapidity, with a minuteness, steadiness, and accuracy, that exceed comprehension.

It would be unnecessary to repeat here a minute description of the mode in which these muscles co-operate; they co-operate with, and co-operate exactly in the same manner as, the four pairs of the first class; the sternal halves inclining the head sternad, the dorsal dorsad, the dextral dextrad, and the sinistral sinistrad, in the several diagonals of their respective forces. They differ, however, from the first class of muscles in moving the neck as well as the head, and in being employed in the rotatory motions when the head is rolled, through the medium of the atlas, on the vertebra dentata.

Of the Rotatory Motions of the Head.

These motions are common to the head and atlas; which, during rotation, preserve the same relative position, in consequence of the muscles of the first class acting as fixors, and assisting the joint in opposing the forces that might chance to roll either of them singly dextrad or sinistrad. The joint on which these motions are performed differs from all the other joints of the vertebral column; while it scarcely admits of any sensible flexion and extension, like the other joints belonging to the moveable part of the column, it has no intervertebral cartilage or ligament to restrain the motions dextrad and sinistrad when the one bone is rolled upon the other in a plane perpendicular to the tooth-like process.

The muscles employed in producing these motions are nine pairs.

On the sternal aspect.	*Directions of action.*
Latissimi colli,	Sac. dor. laterad.
On the dorsal aspect.	
Obliqui capitis inferiores*,	Sac. dor. mesiad.
Pars spleniorum colli,	Sac. dor. mesiad.

and all the muscles that were last enumerated†; excepting the *interni capitis majores*, which, like the

Scaleni medii,
Longi colli,
Levatores scapularum.

* Vide p. 178. † See page 318.

and that chain of muscles which, connecting the maxilla with the sternum and scapulæ through the os hyoides, have scarcely any influence in rotation, although they be extended over the joint on which the rotatory motions are performed.

During these motions, the muscles peculiar to the head and atlas, and the muscles of the neck, from the vertebra dentata downwards or sacrad, become fixors; and thus the inclinations of the head and neck, arising from the action of the rotatory muscles being every where prevented, the only directions in which they can sensibly exert their forces must be *laterad* and *mesiad*; in which directions, if they act alternately, the head must move, without inclination, dextrad or sinistrad, on the vertebra dentata. But as in these motions the two halves of the same pair cannot co-operate, the muscles employed to roll the head dextrad are,

On the sternal aspect,	*Directions.*
Latissimus colli *,	Dexter.
Sterno-mastoideus †,	Sinister.
On the dorsal aspect,	
Pars trapezii ‡,	Sinistri.
Splenius capitis ‡,	Dexter.
Splenius colli,	Dexter.
Complexus ‡,	Sinister.
Rectus capit. post. major ‡,	Dexter.
Obliquus capit. inferior ‖,	Dexter.
Trachelo mastoideus †,	Dexter.

* Vide Maxilla basilaris, p. 176.
† Ossa temporalia, p. 168.
‡ Os occipitale, p. 170.
‖ Processus spinales, p. 178.

the remaining halves of the same pairs rolling it sinistrad, and the two halves of the same pairs acting alternately as moderators and motors.

Of all these muscles employed in rotation, the principal are evidently the *obliqui capitis inferiores*. These muscles, arising from the spine of the vertebra dentata, advancing laterad, and almost directly, to the two transverse processes of the atlas, are, from their direction and the nature of the joint, rendered incapable of producing, at least sensibly, any inclinations dorsad or laterad; and are therefore restricted almost entirely to rotatory motions: the dextral rolling the atlas dextrad, and the sinistral rolling it sinistrad.

As to the *recti interni majores*, they can have but little influence in rotation, from the shortness of their lever, and from the slight degree of their obliquity. Even the two *trachelo-mastoidei*, from their slight obliquity, are rotatory only when the head is turned to the opposite side. For the same cause, the *scaleni medii* and *levatores scapularum*, though attached to the atlas, can scarcely be reckoned among rotatory muscles, being, like the *recti interni majores*, defective both in obliquity and lever.

With respect to the muscles which, through the medium of the os hyoides, connect the maxilla with the sternum and scapulæ, those between the maxilla and hyoides, as already has been shown*,

* Vide p. 100.

can exert no influence whatever in rotation; while the sterno-hyoidei, supposing the head, the maxilla, and hyoides, to preserve the same relative positions, have not the degree of obliquity that is necessary; and though that obliquity be not wanting in the omo-hyoidei, yet it seems to be given for another purpose, to prevent the hyoides from being carried dextrad and sinistrad with the head and the maxilla. Accordingly, during the rotation of the head and the lateral motions of the basilar maxilla, we may generally observe that the os hyoides remains stationary, and that often the tones of the voice are unaltered.

The vulgar notion, that the *sterno-mastoidei* are the only, or principal, rotators of the head, and the project for dividing a supposed offending *sterno-mastoideus*, when the head is awry for any length of time, must, from what we have seen of the rotatory muscles, be a notion and project without any countenance whatever from anatomy. As other rotators may in these cases be acting irregularly, on what principle can an operation, that extends but to one of the rotatory muscles, remove the distortion? Or, suppose that one of them only is in fault, and that this muscle is divided by the knife; on what principle are we to be sanguine in our expectations as to the manner in which the separated parts are to unite? If the space interposed between the two divided extremities be not filled

up with carneous fibres, which is not very probable, and with carneous fibres of the same kind and the same direction as the separated fibres, which is still less probable; or if the muscle, in whatever way repaired, shall, after its reunion, be longer or shorter than its fellow and antagonist of the opposite side, on what grounds are we to imagine that these two muscles shall afterwards co-operate, and moderate one another with accuracy and precision? Or if the two divided extremities shall form adhesions with either the integuments or the neighbouring muscles, from what data are we to conclude, that such adhesions will not retard, rather than facilitate, the natural motions of the head and neck? Or, supposing that the two divided extremities shall so retract as never to unite, on what principle are we to explain how its fellow, that is now left without an antagonist, shall not distort the neck more powerfully than ever? Or, suppose again the mere possibility that the muscular affection is only symptomatic; that it may arise, like some of the occasional spasms in rheumatism, in cramp, in epilepsy, in tetanus, in hysteria, or in the *tic douloureux*, from a distant cause irritating the nerves, or from the inaction and debility of the muscle that was wont to oppose it (as muscles are frequently observed to grow rigid when not antagonized), with what confidence are we to proceed to the operation? on which of the muscles, the weaker or stronger, are we to ope-

rate? and with what probability are we to inspire the hopes of a recovery?

In such cases, a circular bandage tied round the head, with a similar bandage encompasing the chest, immediately sacrad of the two axillæ, and both these bandages connected by straps, in such a manner as to regulate the positions of the head and neck, and extend their effects to the functions of all the different muscles employed in regulating their motions and attitudes, would certainly, *a priori*, appear preferable to the operation. Yet, from these observations, we mean not to infer that the operation has never been successful. A random jerk given to a watch has occasionally been found to restore its motions, though surely never recommended as a method that would do much credit to an artist who is acquainted with the mechanism of a timepiece*.

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* In the sixth volume of the *Disputationes Anatomicæ Selectiores*, which were published by Haller, there occurs a paper, entitled, "*Quæstio Medica*, Jacobo Benigno Winslow Preside, *An in cognoscendis Morbis, Errores funestos vitare possit Anatomes parum duntaxat gnarus?* respondente Petro Roussin de Montabourg, *Paris*, 1732." From that paper the following account, respecting the distorted neck of a female, will not, I think, be unacceptable to any reader who is interested in anatomy or surgery.

"Mulieri cuidam, variis hyemali tempore factis itineribus, ægrotanti, ac rheumaticis hinc doloribus vehementer afflictæ, collum adeo devenit obtortum, ut alteri humero facies obversa fu-

erit; eidemque mentum semper ita affixum, ut nunquam, nisi manuum ope antrorsum, reduci posset, nec in situ naturali permanere, nisi alienis detentum adminiculis. Huic affectui curando trimestre tempus impensum est. Varia interim varii tentaverant remedia. Omnia incassum, nullus successus, nulla spes. Vocatur demum ille, qui anatomicâ lance singulis ad amussim trutinatis errorem detexit, nimirum parti illæsæ omnia hactenus adhibita fuisse medicamina, affectæ vero nulla; imo partem incolumem erroneâ medicatione ita demum tumuisse, ut vera mali sedes focusque morbi clandestinus putaretur magis magisque. En vero, inquis, insignem tum in cognoscendo, tum in curando errorem! Causam quæris? Anatomes imperitos culpato. Viderant isti jam pridem, vel saltem audiverant, in oris hemiplegia non ægrotare latus illud in quod tunc labia feruntur, sed oppositum. Putaverant forsan idem in obtorto collo observandum fore, adeoque de latere, cui caput incubuit, nil mali suspicantes, deceperat in altero latere tumor levi tensione stipatus. Quinam vero tumor, quænam tensio? Credidisses? Nil profecto nisi quod in naturali musculorum mastoïdeorum actione pa reciprocâ fieri solet, hic contigisse animadversum est. At parum gnaros vel omnino imperitos anatomes errasse de musculorum horumce statu morboso, non est quod mireris. De solitis et nativis eorumdem functionibus, istos etiam errasse suspicio est. Musculos mastoïdeos alternis vicibus capiti in alterutrum latus tanquam circa axim colli circumagendo inservire, docet anatome, asserit inspectio, probat tactus. At ne hallucineris, obliquam eorundem directionem attentus, imo cautus, observa. Dextro musculo sinistrorsum, dextrorsum sinistro moveri, non oblivisccre Memento insuper, reliquorum musculorum oblique duntaxat moventium parem esse machinam. Anatomes gnarum non fefellit attenta capitis ad alterutrum humerum invite conversi, et illac invite labentis, inspectio. Judicavit is contigisse paralysin in musculo mastoïdeo ejusdem lateris, in quod recubuit obtortum caput, alterum vero musculum mastoïdeum naturali quadam tensione riguisse. Neque judicasset aliter,

quamvis multoties antehac observaverit alterutrius genæ paralysin, non latus in quod os tendit, sed illud a quo discedit, affecisse. Jussit illæso musculo hactenus applicata removeri statim, eademque utpote convenientia imponi læso. Cogitavit inveniendum fore medium, quo caput ipsamet ægrota absque sedilis, lecti, manuumque adminiculo tenere posset tantisper, dum continuatâ remediorum ope sanitati restituerentur affectæ partes. Cepit in arenâ consilium; expeditum ac paratu facillimum ipsissimo fere momento ex anatome promisit artificium. Nec mora, experimentum fecit; optimo præter expectationem successu. Una fidelia duos, ut aiunt, parietes dealbavit, uno bis percussit ictu. Lapsum caput et collum obtortum unico instrumento et restituit, et ad libitum movit. O secretum! clamitas! Tace tantisper; non hic quærendus Oedipus; Davus rem acu tangeret, modo gnarus anatomes. En paucis: Fasciæ longioris, parum latæ, seriebus aliquot frontem, tempora, atque imum occiput ægrotantis circumdedit, factâ circumductione ad latus lateri oppositum. Reliquam fasciæ portionem obliquo ductu pone scapulam ejusdem lateris retro demisit, inde sub axillam reduxit antrorsum, reductam trahere perrexit alterâ manu, alterâ prolapsum caput ad naturalem situm sensim et leniter simul perducens. Simplicis experimenti successus duplex; scilicet obtorto collo, non minus ac labefacto capiti, succurrit. Eâdem fasciâ binas languentis musculi operationes obliquitate faustâ supplendo caput sustinuit, collum restituit, utrumque pro lubitu ægrotantis ultro citroque movit, instar habenæ modo laxatâ, modo tractâ, modo retentâ.

CHAP. II.

OF THE MOTIONS OF THE NECK.

These motions, exclusive of the motions on the vertebra dentata, consist of inflections

Sternad,
Dorsad,
Dextrad,
Sinistrad,

and in all the intermediate directions. As for the idea of rotatory motion which is sometimes ascribed to the cervical vertebræ that are situated sacrad of the vertebra dentata, it has partly arisen from a cursory view of the different inflections following one another in a particular order of succession; as when the head and the neck together are made to move as it were on a pivot, describing a cone, the base of which is towards the head, and the apex at the sacral extremity of the neck. A similar motion is observed in the humerus, when the arm is extended, and the hand is made to move in a circle; but in neither case are either the cervical vertebræ or humerus observed to turn round on their axis.

A rotatory motion, similar to that between the atlas and vertebra dentata, is prevented in the other cervical vertebræ, by articulation, by the length of their spines, by their intervertebral cartilages and ligaments, by the *musculi interspinales*, and the *intertransversarii priores et posteriores*, which, both from their shortness and from their direction, will resist any force that may have a tendency to roll the vertebræ dextrad and sinistrad on their own axis. At the same time, that range of freedom in the several joints, which is absolutely necessary to varied inflection, renders them susceptible, in a slight degree, of a lateral contortion, which, though scarcely sensible between any two contiguous vertebræ, becomes conspicuous when a number of vertebræ are moved together. It is evidently to these degrees of contortion, and to the inflections following one another in a particular order of succession, that we are to ascribe the optical deception which has suggested the idea of rotation; an idea, certainly, which neither an accurate view of the phenomena, nor an anatomical inspection of the structure, are calculated to support.

The muscles by which the inflections are performed may be divided into three classes: the first class consisting of those which act through the medium of the basilar maxilla*; the second, of those which are attached to the bones of the cra-

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* See pages 316 and 317.

nium*; and the third, of those which act directly on the cervical vertebræ. Of this third class, reckoning the groups only as pairs, the pairs will amount to fourteen.

On the sternal aspect.	*Directions of action.*
Longi colli †,	Sac. laterad.
On the lateral aspect.	
Scaleni priores †,	Sac. ster. laterad.
Scaleni medii †,	Sac. laterad.
Scaleni postici †,	Sac. dor. laterad.
Levatores scapularum †,	Sac. dor. laterad.
Intertransversarii †,	Sacrad.
On the dorsal aspect.	
Rhomboidei minores †,	Sac. laterad.
Serrati postici superiores †,	Sac. laterad.
Splenii colli †,	Sac. dor. laterad.
Cervicales descendentes †,	Sac. dor. laterad.
Transversales cervicis †,	Sac. dorsad.
Spinales cervicis †,	Sac. ster. laterad.
Interspinales cervicis,	Sacrad.
Multifidi spinæ †,	Sac. ster. laterad.

That these muscles may not only move, but strengthen the cervical articulations, there is no process, spinous or transverse, in the cervical regions, to which two or more of them are not attached; and no process to which any two of them, not belonging to the same pair or the same group, are not inserted at a different angle ‡.

* See page 318.
† Vide vertebræ cervicis et earum processus, p. 173, 179
‡ See page 319.

As all muscles, belonging either to pairs or to groups, and which are attached to the vertebral column, must, as well as the *scaleni*, *levatores scapularum*, and *intertransversarii*, be situated either dextrad or sinistrad of the mesial plane, and consequently, when not prevented by antagonists, must, when acting on the column, necessarily inflect the points of their attachment in a lateral direction ; it may naturally be asked, why the *scaleni*, the *levatores scapularum*, and the *intertransversarii*, should here be assigned to the lateral aspects, as if they had something peculiar in their functions? The answer is, that those muscles are not well seen from either the dorsal or the sternal aspects; and that although the *scaleni antici* may exert some force in the sternal direction, the *scaleni postici* and *levatores scapularum* in the dorsal direction, yet, like the *intertransversarii* and *scaleni medii*, they scarcely exhibit sensible action in either the sternal or dorsal directions.

The *rhomboidei minores* and *serrati postici superiores* have here been introduced among the dorsal inflectors of the neck, because, in cases where the ribs and scapulæ are more fixed than the cervical vertebræ, to which they are attached at the opposite extremity, they must necessarily inflect the vertebræ dorsad.

From the circumstance that muscles producing any change on the vertebral column must exert a force in the lateral direction, in summing up those which are employed in the several inflections of the

head and neck, I shall arrange them into two classes only: the first class consisting of those which inflect sternad; and the second, of those which inflect dorsad.

The muscles belonging to the first class, or those which inflect in the sternal direction, are,

Latissimi colli
Biventres maxillæ
Mylo-hyoidei
Genio-hyoidei
Genio-hyoglossi
Omo-hyoidei
Sterno-hyoidei
Thyro-hyoidei
Sterno-mastoidei
Recti capitis interni majores
Recti capitis interni minores
Recti capitis laterales
Longi colli
Scaleni antici.

The muscles belonging to the second class, or those which inflect in the dorsal direction, are,

Partes trapeziorum.
Rhomboidei minores
Serrati postici superiores
Splenii capitis
Splenii colli
Complexi
Trachelo-mastoidei
Cervicales descendentes
Transversales cervicis
Spinales cervicis
Semispinales cervicis
Multifidi spinæ
Recti capitis postici minores

Recti capitis postici majores
Obliqui capitis superiores
Obliqui capitis inferiores
Scaleni postici
Levatores scapularum.

From these enumerations the *intertransversarii* and *scaleni medii* have been excluded, as they properly belong to neither the sternal nor the dorsal aspects, with respect either to situation or function; though, if I were to class the *scaleni medii* with either the dorsal or the sternal muscles, I should, from the instances which I have seen, be rather inclined to class them with the dorsal. In the lateral inflections of the head and neck, they are but a part of the muscles employed, and only assist the half of the sternal, and the half of the dorsal, on their own side of the mesial plane.

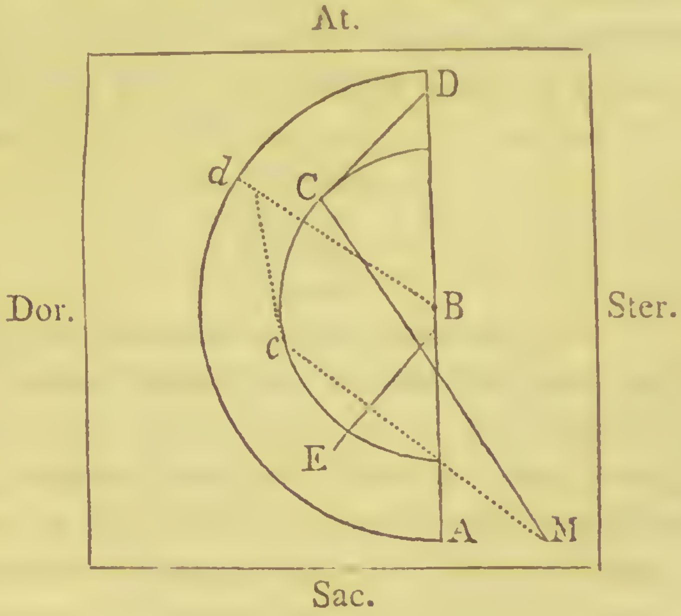
As the muscles which inflect the head and the neck, by acting through the medium of the os hyoides, can never exert a force that is greater than the joint forces of the *sterno-hyoidei*, *omo-hyoidei*, *sterno-thyroidei*, and *thyro-hyoidei*, we are naturally led to make the inquiry, why the dorsal muscles are more numerous, more powerful, and many of them possessed of longer levers, than their antagonists which are situated sternad? In making this inquiry, the following circumstances will almost unavoidably present themselves on the slightest observation. In the erect position of the neck, when the head rests on the cervical vertebræ, with its base at right angles to the axis of the trunk, its

centre of gravity falls sternad of its centre of motion; and hence it is evident, that the muscles situated on the dorsal aspect have not only to moderate the sternal muscles, but to counteract the effects of gravitation; and as gravitation operates constantly, the dorsal muscles must also counteract it with comparatively small degrees of exertion, that they may not be fatigued when the head is continued long in that posture. Were the cervical column to be placed horizontally, even these muscles, strong as they are, could not support the weight of the head for any considerable length of time, without being liable to pain or uneasiness. And therefore, in quadrupeds, where the neck is near the horizontal position, the dorsal muscles are always assisted by two ligaments, which are naturally insensible, which arise from the spines of the dorsal vertebræ, and which run in contact, parallel and atlantad, to be attached to the cervical spines, and to the inial part of the occiput. At the same time, the head and the neck are often inflected against vigorous resistances on the dorsal aspect, but seldom against any similar resistances on the sternal aspect.

This obvious difference, with respect to strength, lever, and number, between the muscles of these two aspects, seems to be the reason that, in cases of tetanus, where the distribution of the nervous energy is no longer influenced by the will, the neck is powerfully inflected dorsad, and it and

the diaphragm made to sympathise, from their connection by the phrenic nerves. A similar difference, in point of strength, exists between the muscles that open and shut the basilar maxilla, and between the muscles on the rotular and popliteal aspects of the legs; where the stronger muscles, on the slightest derangement in the distribution of the nervous energy, are liable to spasms, from the want of antagonists sufficiently powerful to moderate and oppose them.

The following figure is meant to illustrate how muscles, situated on the dorsal aspect, may exert a force in the sternal direction, and yet, notwithstanding, inflect the parts dorsad.



Suppose that the four sides of the square represent four of the principal aspects, the atlantal, sa-

cral, sternal, and dorsal; that AB and BD are two vertebræ, BE and DC their spinous processes; that AB is fixed, BD moveable on the centre B; and that it is moved by the muscle MC, exerting a force sacrad and sternad towards its origin at the point M: it must be evident, that if MC contract to the length of M *c*, it must necessarily bring the vertebra BD to the situation of the dotted line B *d*, which, in every part, except at the centre, is dorsad of BD.

CHAP. III.

OF THE MOTIONS OF THE TRUNK.

The trunk may be moved on the head and neck, and upon the atlantal and sacral extremities. But the motions which previously demand our attention are those performed on the head of the sacrum, and upon the dorsal and lumbar vertebræ; which, like those of the neck sacrad of the atlas, consist of inflections

Sternad,
Dorsad,
Dextrad,
Sinistrad,

and in all the intermediate directions.

As for the motion that is termed rotatory, and of which some of the vertebræ of the trunk have been thought susceptible, it is a motion so very imperceptible, that one should hardly be accused of scepticism although he were inclined to doubt its existence. If we only reflect on the great length of some of the processes of the dorsal vertebræ; how their spinous processes are closely connected by short

carneous or tendinous fibres; how their transverse processes are articulated with the ribs; how the bodies of most of these vertebræ are articulated with four; how these ribs, from the decussation of the two strata of the *intercostales*, and, from several strong muscular attachments, are, except when they change their degrees of inclination to the axis of the trunk, prevented from sliding dextrad and sinistrad,—it can scarcely be imagined that much rotation ever takes place in the region of the thorax. And as for the rotation which has generally been ascribed to the vertebræ of the loins, it has, I think, been ascribed too hastily, without the necessary investigation, and without any clear satisfactory evidence. Independent of the strength, the closeness of adhesion, and the little elasticity in the *ligamenta antica* and *postica*; independent of the strength and the shortness of the fibres in the *ligamenta intervertebralia*; and independent of that decussation observed between the fibres of contiguous strata *, the slightest inspection of the lumbar vertebræ may satisfy the mind that their oblique or articular processes are calculated to check, rather than to favour, rotatory motion. Should such a motion, however, be inferred from the oblique direction of the muscles, it need only

* The ligamenta intervertebralia are composed of numerous concentric strata.

be observed, that a similar articulation of the lumbar vertebræ, and a similar obliquity of the abdominal muscles, are to be met with in numbers of quadrupeds, where the rotatory motion never takes place, and where it is evident would not only be useless, but attended with danger. In short, the remark concerning the *recti postici minores* and *obliqui capitis superiores**, may fairly be extended to all oblique muscles. Such muscles produce rotatory motion only in cases where the joints admit of it, and only when made to act alternately in opposite directions. Wherever the ligaments and articulations are so formed as to resist these kinds of motions, oblique muscles are at all times thrown into action, so as to produce diagonal motions; by which means, that very obliquity which would, in cases where they acted singly, have enabled them to produce rotatory motion, enables them now only to resist it with the greater energy.

The opinion concerning the rotatory motions of the lumbar vertebræ seems to have arisen, like that concerning the motions of the neck, from a kind of optical deception, which not only has led many anatomists to overlook the nature of the joints, but to explain the obliquity of the muscles on a false hypothesis. On requesting some gentlemen, who believed implicitly in these rota-

* See page 314, 315.

tory motions, to exhibit a specimen, I generally observed, that at first they insensibly rolled the head and moved the shoulders, the one of them backwards and the other forwards, as if they had been rolling them along with the trunk on the lumbar vertebræ. But on pointing out the source of their deception, and on causing them afterwards to continue their head, their neck, and their shoulders in the same relative position to the trunk, and at the same time to guard the trunk against every inflection, I never could perceive in their future attempts any thing resembling rotatory motion, excepting a slight degree of rotation on the heads of the femora. This slight rotation, however, they asserted, proceeded necessarily from the lumbar vertebræ, as they produced it not only when standing, but while they were sitting, and while the pelvis, as they thought, must have been stationary, resting on the two tuberosities of the ischia. To remove any doubts, and to convince them of what was the fact, I placed a rod of some feet in length across the sternal aspect of their ilia; and so attached it, through the medium of their dress, that the slightest rotatory motion of the pelvis, must have been indicated by the ends of the rod, which moved round in a larger circumference than any peripheral part of the pelvis. With the rod thus attached, they attempted again rotatory motion on the lumbar vertebræ; but no motion of the kind was perceived, that was not easily, by the help of the index, traced to

the joints where the femora and pelvis mutually roll upon one another. As men, however, generally feel a sort of reluctance in renouncing an opinion that has long been a favourite, and which their own observation has confirmed, they insisted that the joints of the lumbar vertebræ admitted of contortion as well as the cervical; and that this contortion, particularly in dancers, vaulters, and tumblers, and persons accustomed to feats of agility, might be often so extensive as to deserve the name of rotation; and if rotation in one degree, why not also rotation in another. To this reasoning I could only reply, that if rotation and contortion be distinct, the distinction ought to be expressed in language; for although, to prefer a vague term to one that is accurate be often convenient to suit an hypothesis, it never is necessary to the interests of science.

My apology to those who may think I have dwelt longer than necessary on these motions of the lumbar vertebræ is, that Winslow entertained a different opinion*; and to differ from Winslow hastily and rashly about the function of a joint or

* Les portions superieures et anterieures de l'oblique externe d'un côté, conjointment avec les portions inferieures de l'oblique interne de l'autre côté, servent à tourner le thorax sur le bassin, comme sur un pivot, pendant que le bassin reste fixé et arrêté par la session. Ce mouvement peut être appellé rotation du thorax sur le bassin. Tome 2de, § 130.

a muscle, would have argued a degree of vanity and presumption, of which I would not willingly be thought guilty. If I differ from him here, I am conscious I do it with that feeling of deference and esteem which is due to superior industry and genius, and due also to the memory of one, whose name, like those of Vesalius and Harvey, Albinus and Haller, shall ever be dear to my recollection.

Convinced by the reasons already assigned, that no part of the vertebral column belonging to the trunk is susceptible of any thing that can strictly be termed rotatory motion, I shall enumerate the several muscles employed in its inflections: and, to avoid unnecessary distinctions, that create confusion, shall divide them at present into two classes; into those which act directly on the vertebræ, and those which act indirectly through a medium: warning the reader that many of the muscles which are here represented as acting directly will, with a change of the fixed points, act indirectly; and *vice versa*, if they be not attached at both their extremities to the vertebral column.

Of the first class, or of those which act directly on the vertebræ, there are,

On the sternal aspect,	*Directions of action.*
Psoæ magni *,	Sac. laterad.
Psoæ parvi †,	Sac. laterad.

* Vertebræ dorsi, p. 130. † Vertebræ lumborum, p. 181.

On the lateral aspect,	*Directions of action.*
Intertransversarii,	Sacrad.
Quadrati lumborum ¶,	Sac. laterad.
On the dorsal aspect,	
Spinales dorsi §,	Sacrad.
Interspinales dorsi §,	Sacrad.
Semispinales dorsi §,	Sac. laterad.
Multifidi spinæ dorsi §,	Sac. laterad.
Serrati postici superiores §,	Sac. laterad.
Rhomboidei majores §,	Sac. laterad.
Longissimi dorsi §,	Sac. mesiad.

Which last pair terminates, however, partly in the ribs.

Of the second class, or of those that act indirectly through a medium, there are,

On the sternal aspect,	*Directions of action.*
Pectorales *,	
From the clavicles to the humerus,	Sac. laterad.
From the humerus to the sternum and ribs,	Sac. ster. mesiad.
Serrati antici †,	Sac. ster. mesiad.
Recti abdominis ‡,	Sacrad.
Pyramidales,	Sac. laterad.
On the lateral aspect,	
Serrati magni ‖,	Sac. sternad. Sac. laterad.

¶ Vide processus transversi, p. 132.

§ Vertebræ dorsi et eorum processus, p. 180, 181.

* Vide p. 188. † Vide scapulæ, p. 186.

‡ Vide pubes, p. 201. ‖ Vide costæ, p. 185.

On the dorsal aspect,	*Directions of action.*
Trapezii *,	Sac. dor. mesiad.
Latissimi dorsi *,	Sac. dor. mesiad.
Sacrolumbales †,	Sac. mesiad.
Serrati postici inferiores †,	Sacrad. Sac. mesiad.
On the sternal and lateral aspects,	
Obliqui externi abdominis †.	
From the ribs to the linea alba,	Mesiad. Sac. ster. mesiad.
From the ribs to the ilium,	Sac. sternad.
From the linea alba to the ilium,	At. dor. lat. At. lat.
On the sternal, lateral, and dorsal aspects.	
Obliqui interni abdominis †.	
From the ribs to the vertebræ,	Sac. dor. mesiad.
From the ribs to the ilium,	Sac. lat. dor. mesiad.
From the linea alba to the ilium,	Sac. lat. Lat. At. lat.
Transversi abdominis †.	
From the linea alba to the ribs,	Lat. Lat. dor. Lat. dor. mesiad.
From the linea alba to the vertebræ,	Lat. dor. mesiad.
From the linea alba to the ilium,	Laterad.

Their fibres every where running in planes, at nearly right angles to the axis of the trunk, or nearly horizontal when the body is erect.

If it should be asked, why the

Psoæ magni,
Muscles of the femora ;
Serrati postici superiores,
Muscles of the ribs ;

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* Vertebræ dorsi et eorum processus, p. 180, 181.

† Vide costæ, p. 185.

Trapezii, seu cucullares,
Rhomboidei majores,
Serrati magni,
Serrati antici,
Muscles of the scapulæ;
The pectorales, and
Latissimi dorsi,
Muscles of the humeri;

should be here introduced as muscles of the trunk? it may be replied, that the motions of the trunk are only indeed their secondary functions, though these functions be often exercised in many of the more vigorous inflections of the vertebral column.

When the pelvis and femora are preserved in the same relative position, the *psoæ magni*, upon their contraction, must necessarily assist in bending the lumbar vertebræ sternad.

The *serrati postici superiores*, though calculated chiefly to fix the ribs, or to move them atlantad, must, in those cases where the ribs are more fixed than their vertebræ, inflect their vertebral attachments dorsad.

The *serrati postici inferiores*, like the *sacrolumbales*, inflect dorsad through the medium of the ribs, but with a very inferior force, from the smallness of their size, from their running chiefly in the lateral direction, and therefore exerting little more force in the sacral direction than what is sufficient to depress the ribs in which they are inserted.

When the scapulæ and ribs preserve the same

relative position, and the part of the trunk where they are situated is less fixed than where the *trapezii* originate from the spines of the dorsal vertebræ, these parts of the trapezii, upon their contraction, must inflect their moveable attachments dorsad.

When the scapulæ are more fixed than the spines to which the *rhomboidei majores* are attached, these rhomboidei, like the *minores*, instead of affecting the relative position of the scapulæ and ribs, must also inflect their vertebræ dorsad.

When the scapulæ and ribs preserve the same relative position, the *serrati magni* and *serrati antici*, on drawing the scapulæ sternad and sacrad, must extend their influence, through the *rhomboidei*, to the spines of the vertebræ; and if that influence be resisted only by a moderating force, must inflect them sternad.

When the scapulæ and humeri preserve the same relative position with respect to the trunk, and the parts of the trunk where they are situated, or to which they are attached, resist only with a moderating force the *pectorales* and *latissimi dorsi*, the *pectorales* will inflect the parts sternad, and the *latissimi* inflect them dorsad.

As all the muscles inflecting the trunk must inflect it either dextrad or sinistrad, and more or less, *cæteris paribus*, according to their degree of obliquity, or according to their distance from the mesial plane, I shall now arrange them as they inflect it sternad or dorsad; supposing that the reader al-

ready understands how the motors in each case are moderated and directed *.

The inflectors sternad are the

Pectorales
Serrati antici
Serrati magni
Obliqui externi abdominis
Obliqui interni abdominis
Transversi abdominis
Recti abdominis
Pyramidales
Psoæ magni
Psoæ parvi

The inflectors dorsad are the

Trapezii, seu cucullares
Rhomboidei majores
Latissimi dorsi
Serrati postici superiores
Serrati postici inferiores
Sacrolumbales
Longissimi dorsi
Spinales dorsi
Semispinales dorsi
Multifidi spinæ, dorsi, et lumborum
Intertransversarii dorsi et lumborum
Quadrati lumborum

The two last, the *intertransversarii* and *quadrati lumborum*, are here enumerated with the dorsal inflectors, because they are dorsad of the centre of motion, and accordingly relaxed in the dead body, when the trunk is inflected in the dorsal direction.

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* See p. 303, 304, 313.

The *transversi abdominis*, from their very slight degree of obliquity, have but little influence in the lateral inflections, although they co-operate with the *obliqui externi* and *interni* in all the various inflections sternad through the medium of the *recti*; the manner in which they act upon the recti being similar to the manner in which the carneous fibre CD is represented as shortening the tendon AB*.

At the lumbar vertebræ, the *transversi* originate by two tendons; one of them dorsad, and the other sternad, of the *quadrati lumborum*: whence the *quadrati* are inclosed in a sheath regulated by the actions of the *transversi*.

At the lumbar vertebræ, the *obliqui interni* likewise originate by two tendons: one of these tendons from the spinous processes, in common with the tendons of the *latissimi dorsi*; the other from some of the transverse processess, in common with the dorsal tendons of the *transversi*. By uniting afterwards, they form a sheath for a small portion of the *longissimi dorsi*, the *sacrolumbales*, and *multifidi spinæ*. Soon after their union they terminate in oblique carneous fibres; and these carneous fibres afterwards in a tendon, which advancing to the *linea semilunaris*, divides in the region called *umbilical* into two strata: one of these strata running dermad of the *recti*, and uniting with the tendon

* See page 274.

of the *obliqui externi;* the other running central of the same *recti*, and uniting with the tendon of the *transversi*: after which, they soon advance to the *linea alba*, are again united, and at the same time closely interwoven with all the tendons of both the same and the opposite sides.

From the tenth rib, atlantad, or in the region termed *epigastric*, the *obliqui interni* cease to be carneous, and consequently exhibit no tendon divided into strata. The two strata, however, of the umbilical region are, from the oblique direction of their fibres, continued atlantad, preserving their connection with the *obliqui externi* and *transversi;* the central stratum sometimes attached to the cartilages of the ribs, and sometimes running without such attachment along their curvatures.

In that region termed *hypogastric*, the tendons of the *obliqui* and *transversi* run dermad of the *recti*, where, in the vicinity of the symphysis pubis, the fibres of the *obliqui externi* are, more distinctly than in any other place, seen extending across the *linea alba*, and decussating one another at different angles according to their degrees of obliquity; yet, sacrad of the aperture that transmits the spermatic vessels of the male, or the *ligamentum rotundum* of the female, the tendons of the *obliqui externi* stretch only to the pubes of their own side, when, instead of proceeding in their usual directions sacrad, sternad, and mesiad, they run atlantad, dor-

sad, and laterad, to be inserted in the spines* of the pubes between the *recti* and the *pectinei*. By this change of direction, the tendon is at one part

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* The central fold, which is very accurately described by Sabbatier, is sometimes called the ligament of Gimbernat, who, in a small treatise which he published, endeavoured to show that this fold is the cause of stricture in crural hernia. What is generally understood by the ligament of Poupart, is that tendinous part of the *obliqui externi* to which the femoral fascia is attached. At that attachment some strong aponeurotic fibres are seen extending from the crest of the ilium to the crest of the pubis. Winslow calls these the *inguinal ligament*, or the *ligament of Fallopius*, and says that he has found them sometimes wanting. Sabbatier denies that Fallopius has ever mentioned such a ligament; and Portal, on the contrary, asserts that Fallopius has described it much more accurately than Poupart.

"Le ligament inguinal, ou ligament de Fallope, qui'l decrit le premier, est une bande ligamenteuse ou aponeurotique attachée par un bout a l'epine anterieure superieure de l'os des iles, et par l'autre a l'epine de l'os pubis. Il est fort etroit le long de ses portions moyennes, et s'elargit considerablement vers ses extremités. Il est fortement uni aux muscles du bas ventre, et a l'enveloppe aponeurotique de la cuisse. Souvent il paroit manquer, comme je ferai remarquer dans l'exposition de ces muscles." Winslow. *Traité des Os Frais*, § 119.

"La partie de l'aponeurose du grand oblique, qui l'etend depuis le pubis jusque a l'epine anterieure et superieure de la crête des os des iles, ne tient à rien qu'à l'enveloppe aponeurotique du muscle de la cuisse qui est connu sous le nom de *fascia lata*. Le rebord qu'elle forme est épais, qui paroit venir de ce qu'elle est, pour ainsi dire, repliée sur elle même, de devant

doubled on itself; and being attached, where the doubling commences, to the fascia of the thigh, and likewise, through the medium of a cellular membrane, to the integuments, where their surface

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en arrière, et de bas en haut. Ce bord, a l'apparence d'un ligament, et porte effectivement le nom de ligament inguinal, ou de Poupart, de celui d'un anatomiste François, auquel on en attribue la decouverte. Quelq'uns l'appellent le ligament de Vesale ou de Fallope, quoique ni l'un ni l'autre de ces anatomistes n'en eut fait mention." SABBATIER. *Traité de la Myologie. Oblique Externe.*

" Poupart decrit deux gros ligaments ronds fort visibles. ' Dans les grandes personnes ils sont tous de plus d'un demi-pied, et dont cependant les anatomistes n'ont point traité, apparemment parcequ'ils non pas connu leurs usages. Ils sont attachés par un bout sur la crête des os des iles, par l'autre bout sur la crête de l'os pubis, et le milieu porte a faux. Ils font la fonction d'os en cet endroit ; car ils soutiennent les trois grands muscles de l'abdomen. . . . . . Leurs fibres tendineuses sont a-peu-prés paralleles entr'elles, et vont s'attacher à ces ligaments ; ils sont situés immediatement au dessous des anneaux.'

" La description que Poupart donne de ces prétendus ligaments n'est point nouvelle, outre qu'elle est peu exacte. Fallope les avoit connu, et en avoit parlé d'une maniere plus conforme a la nature." PORTAL. *Histoire de l'Anatomie et de la Chirurgie. Siecle* xvii. *Année* 1695.

Fallopius, the first anatomist who has described the *musculi pyramidales*, says they are attached at one part to two ligaments that extend from the spines of the ilia to the ossa pubes. " C'est ce," adds Portal, " c'est ce ligament que l'ignorance a fait attribuer à Poupart, qui a vécu cent ans aprés. Quelle erreur ! quelle faute d'histoire !"

is furrowed in the region of the groin, the central fold is in these circumstances not only concealed, but that part of the tendon where the doubling commences, seems, when examined merely by the eye, a continuation of the tendinous border that, laterad of the vessels and the crural nerve, is attached not only to the fascia of the thigh and the cellular membrane, but also to the fasciæ of the *transversi*, of the *iliaci interni*, and *psoæ*.

The *recti abdominis*, on their dermal aspect, are every where supported by the tendons of the *obliqui externi*, likewise by one of the tendinous strata of the *interni*, from the ensiform cartilage to the sternal and atlantal processes of the ilia; from these processes to the symphysis pubis, by both the strata of the *interni*, which are there undivided, and also by the tendons of the *transversi*. Hence, in the region termed *hypogastric*, there is no stratum of muscular tendon interposed between the recti and peritoneum; and no place where the recti are enclosed by muscular tendon upon all sides, dermad, centrad, dextrad, and sinistrad, except in the region called *umbilical*. In this region, near the extremities and towards the middle, and in the region called *epigastric*, at the tenth rib, the recti are divided by tendinous intersections; and at these intersections, dermad and centrad, but particularly dermad, are attached to the tendons of the lateral muscles, by which the general connections are strengthened, and the parts of the *recti* between the intersections enabled to act as separate muscles.

By these different connections and arrangements, the *recti* and the lateral muscles act reciprocally upon one another as upon pulleys, assist one another in their various functions, and regularly modify one another's forces. Were it not for the *recti*, the lateral muscles could not have been opposed by a moderating force in their actions dorsad; and were it not for the lateral muscles, the *recti* could not have inflected sternad to the usual extent, without a greater decurtation of fibres than would have been consistent with the nature of their functions, with the functions of the nerves, and of the sanguiferous and absorbent vessels that are intermixed with them. Besides, in all the inflections sternad, the abdominal viscera, especially in the region called *umbilical*, would have been protruded, the inflections resisted by such a protrusion, and the viscera compressed between the extremity of the sternum and pubis. Farther, had not the tendons of the lateral muscles, particularly in the region called *umbilical*, been united at the *linea semilunaris*, the lateral strata in their separate contractions might have been detached; and had not these strata after this union again been divided, and again united at the *linea alba*, the lateral forces, instead of being moderated at the *linea alba* by the *rectus* of their own side, or at the *linea semilunaris* by the *rectus* of the opposite, must have been extended to the other halves of the lateral pairs, and the viscera at all times been

equally compressed upon both sides. Lastly, had the tendons of the lateral muscles been stretched across from ilium to ilium on the central aspect of the two *recti*, the *recti* and the lateral muscles could no longer have acted reciprocally upon one another as upon pulleys ; the epigastric arteries and veins must have passed through a tendon, their functions been less dependent on the *recti*, and the *recti* never have been drawn dorsad beyond the sternal and atlantal processes of the ossa ilia.

The use of the *pyramidales* is best seen by examining the *recti* on their central aspect ; for where the pyramidales are present, a triangular space, occupied by transverse tendinous fibres, is generally observed between the *recti* : hence the two *pyramidales*, which not only shorten the linea alba, but compress a little the viscera of the pelvis, necessarily co-operate with these fibres in resisting the separation of the *recti*, and preventing hernia. For a similar reason, the parallel fibres of the obliqui externi are held together by the strong decussating fibres of their aponeurosis; the attachment of the *recti* extended laterad on the spines of the pubis, often as far as the ligament of Gimbernat, and their adhesion greatly strengthened by a periosteum, that usually exhibits the appearance of tendon. Partly, too, for the same reason, the fibres of the lateral abdominal muscles are observed to run in different directions, preventing not only the protrusion of the viscera by their

decussations, but by their obliquity acting at the same time as motors and directors, and performing a greater extent of motion by a less proportional degree of contraction than if they had taken a shorter course between the bones to which they are attached at their opposite extremities.

In all inflections, laterad or sternad, the levers by which the *obliqui* and *recti* act upon the vertebræ, through the medium of the ribs, are lengthened or shortened according as the ribs are elevated or depressed. When the thorax is expanded laterad and sternad, the planes of both the obliqui and recti are in these directions necessarily removed to a greater distance from the centre of motion; and *vice versâ* when the ribs are depressed. Hence one of the reasons why all the vigorous inflections of the trunk are preceded and accompanied by full inspirations.

The *obliqui externi* and *obliqui interni*, from occupying the whole of the lateral aspects, extending between the ilia and ribs, and from acting at the greatest lateral distance from the centre of motion, must always be muscles principally concerned in producing inflections dextrad and sinistrad on the lumbar vertebræ, principal directors in all the inflections sternad and dorsad; and from the assistance which they give to the *recti*, principal librators also of the trunk, whether we be sitting, standing, or walking. When any of these muscles, herefore, are injured, or morbidly sensible, there are

few of the usual inflections or attitudes belonging to the trunk that are not accompanied with more or less pain. In such circumstances a man is compelled either to desist from most of the ordinary duties of life, or to find out a method by which he can perform them without those exertions of the injured muscles by which the pain and uneasiness are excited. Of the two alternatives, to continue the usual employments of life is the most desirable; and it certainly is the business of both the patient and his medical adviser to try if such an object be attainable.

Some years ago, a man, in attempting to recover his balance with a weight upon his shoulders, injured these muscles between the ribs and the crest of the ilium. Unable to continue any longer at his work, he walked home with excruciating pain, went to his bed, and laid himself down on the side that was sound. When I saw him a few hours after, he told me that the pain which he felt in lying down was past all description; that he then could not venture to change his position, although his whole house were in flames; and that he was almost perfectly assured that his back was either broken or disjointed. Notwithstanding the pain which he dreaded, I prevailed upon him to allow me to change his position to the injured side; and placing myself in a similar position, I showed him how to rise to the sitting posture without bringing the injured muscles into any strong action, then

how to stand, at last how to walk, and how to lie down again; which he readily did without much pain, and soon after without feeling any, to his own surprise, and the great joy of his wife and family, who a little before, from viewing his case as incurable and hopeless, had been figuring him in his last struggles with death. On putting the question, whether or not he could move the arm of the injured side as freely and extensively as he did before? he answered, that the arm had never been affected. But on my taking hold of it, and suddenly raising the point of the elbow as high as the head, he uttered a scream that alarmed the neighbourhood. The cause of this pain was to be ascribed, not only to the common attachment of the *latissimus dorsi* and *obliquus internus* in the spines of the vertebræ, but to the connection of the *latissimus* with the *obliquus externus* in the ribs, and to a sudden, though a slight exertion of the injured muscles in preserving the balance when the centre of gravity was somewhat changed. A proof, that in cases where the muscles are injured and the motions impeded, we ought not entirely to confine our views to the seat of the injury, but attend likewise to the various muscles related by attachment, contiguity, or function.

The effects of the injury continued for a week; and during that time the pains were frequently severely felt when the motions and attitudes that had been prescribed were not regularly observed.

In this way, with little interruption to his usual habits, the cure was as speedy, and probably as complete, as if his whole system on a sudden had been made to undergo a general change; as if he had been bled, blistered, and purged; confined to bed and a low diet, and made to sleep by the help of opiates till signs of his convalescence appeared.

The flexures observed in the vertebral column, and which are in general less marked in the young subject than in the adult, are produced chiefly by the action of muscles: yet not produced as if they were merely accidental effects, but evidently as means adapted to an end, contributing their aid in enabling us to balance the weight of the body on its centre of gravity when standing or walking. The well formed vertebral column on the dorsal aspect is, for these reasons, always convex from the os coccyx to the junction of the os sacrum with the ilia, then concave from that part of the sacrum atlantad to near the true ribs, then convex as far as the neck, then concave again till it reach the atlas. Had it been straight, the centre of gravity would necessarily have been so restricted in its range between the dorsal and the sternal aspects, that we could not with steadiness have supported the trunk on its sacral extremities, and at the same time have extended completely the hip and the knee joints, seeing these joints and the joint at the ancle co-operate with the curvatures of the vertebral column, and, like these

curvatures, are also alternately concave and convex on the dorsal aspect. For, if it be obvious that all the parts in the opposite aspects must be *in equilibrio* sternad, dorsad, dextrad, and sinistrad, it is equally obvious that the farther they extend in the opposite aspect, provided they be manageable, the more easily and the more readily will the balance be maintained; as may be seen by lengthening and shortening the extent of the pole by which the dancer balances his body on the tight or slack rope. It is also evident, that when any part of the body is inclined to one side of the centre of gravity, some other part, to preserve the equilibrium, must be proportionally inclined to the opposite. Hence, throwing the atlantal extremity of the trunk considerably sternad of the centre of gravity, so as to touch the ground with the fingers, its sacral extremity must always be thrown proportionally dorsad, and the heel and the knee joints at the same time inflected in opposite directions. Hence no person, with the heels and the sacrum in contact with a wall raised perpendicular to the base on which the heels are supported, can touch the ground with the points of his fingers, and preserve his balance; hence those spines, which are very much bent at one of their curvatures, are generally found proportionally bent at some of the others; and hence those spines which, in consequence of disease, have their curvatures laterad, have them alternately concave and convex on the lateral as-

pects, in the same manner as the well formed spines have them on the sternal and the dorsal aspects.

Of the regular curvatures, that of the sacrum is occasioned by the resistance of the ilia towards its middle, the pressure of the column at one of its extremities, and the force of the *gluteus magnus* at the other;—that extending from the sacrum atlantad to near the true ribs, by the vigorous and repeated exertion of the *sacrolumbales* and *longissimi dorsi*, not only in raising the trunk from the horizontal to the erect position, but in preventing the centre of gravity from falling sternad of the base on which we stand;—that of the neck, by its dorsal muscles, which are always stronger and more numerous than those which are sternal;—and that of the thorax, by the pressure of the parts situated atlantad, by the centre of gravity being there sternad of the centre of motion, by the smaller size and the shorter levers, and consequently the less vigorous exertion of its dorsal muscles. This last curvature is also much increased in *phthisis pulmonalis*, and in many other cases of debility, where the muscles that depress the ribs are relaxed, the shoulders elevated, and several muscles not usually employed in enlarging the chest, are brought to the aid of the intercostals. In such cases, it is generally observed that the balance is preserved when standing or walking by more than usual degrees of inflection in the sacral extremities:

while in advanced periods of life, when the humours are scanty, when the intervertebral cartilages are shrunk, and the vertebral column itself is shorter, the whole is disposed to incline sternad, when the knee and the hip joints are still more inflected, and, in many instances, a staff rendered necessary to preserve the balance.

Nothing resembling the three first curvatures that occupy the sacral, lumbar, and thoracic regions, are in general to be found in the vertebral columns of quadrupeds or birds. From their seldom assuming the erect posture, their more usual centres of gravity and centres of motion are situated differently; and hence in quadrupeds, that remarkable difference in the inclinations of the spinous processes of their moveable vertebræ. In the human species, these processes are all inclined toward the sacrum; to which they are drawn in passing from the horizontal to the erect position, or on which they are balanced by muscular force when they are raised to the perpendicular. To the same point we sometimes observe the first of the spinous processes of the sacrum inclining atlantad. In quadrupeds, again, the appearance is different, and yet evidently proceeds from a similar cause. The spinous processes of both their lumbar and their dorsal vertebræ are regularly inclined to that point near the middle of the column, which forms the common centre of motion between the two extremities of the trunk that are alternately raised and depressed in progressive motion.

The muscles principally concerned in producing these inclinations are, the *latissimi dorsi*, *longissimi dorsi*, *sacrolumbales*, the *semispinales*, and *multifidi spinæ:* the three first drawing the spinous processes atlantad, and the two last drawing them sacrad. Where they all are attached to the same processes, and where they draw with equal frequency and equal force in opposite directions, the processes generally project dorsad; where they are inclined sacrad or atlantad, their degrees of inclination indicate the difference of frequency and force by which they are drawn in these opposite directions. Hence, in examining these processes of the vertebræ, we may in general be able to determine what had been the most usual inflections of the vertebral column, what its principal centres of motion, what its most fixed and moveable points, and what the attitudes and changes of attitude to which the animal, when in life, had been most accustomed.

As these processes are likewise calculated to increase the power of the muscular levers, we are often enabled to conjecture, from their length, where the power of the lever had been principally employed to compensate the force and bulk of the muscles. Thus in the atlantal extremity of the thorax, the spinous processes are considerably longer than in any other part of the column, if the head be heavy, the neck long, horizontally situated,

and comparatively slender; or if the parts situated atlantad of the centre of motion be heavier than those which are situated sacrad, as may be seen in the skeletons of the goat, the deer, and the horse.

With respect to the spinous processes of the cervical vertebræ, which, by means of the *splenii*, the *semispinales*, and *multifidi spinæ*, are inclined differently in different animals, according to the different situations of the points to which they are drawn with the greatest frequency and the greatest force, we observe them often to be much shorter than those of the dorsal or the lumbar vertebræ, particularly in cases where strong ligamenta Nuchæ are present to support the weight of the head and neck, and in those cases where the head is small, the neck slender, and this neck elongated and shortened to regulate the position of the centre of gravity.

As great force is seldom required to give the neck a lateral direction when properly suspended by its ligaments and muscles, the transverse processes of the cervical vertebræ are generally but small, even in animals of a large size. On the other hand, the transverse processes of the lumbar vertebræ, are generally long, where the muscles are found comparatively slender, and yet where a considerable force is required to give the column a lateral direction in the lumbar region: they project laterad, where they are drawn with equal frequency and equal force in opposite directions; in

many animals, laterad and atlantad, where they are drawn with the greatest frequency and the greatest force towards the atlas. The transverse processes of the dorsal vertebræ are regulated chiefly by the nature of the ribs with which they are articulated; and the transverse processes of the os sacrum, which in the adult are always anchylosed, by the nature of the pelvis and the ossa ilia. In the feathered tribes the ossa ilia extend atlantad to the region of the thorax; and in those that fly, neither the dorsal nor the lumbar vertebræ seem to admit of any sensible degree of motion, that the centre of gravity may be more easily and steadily regulated, when they are moved and supported on the wings.

In animals, therefore, where the vertebræ are distinguished into cervical, dorsal, lumbar, sacral, and coccygeal, we must not expect general, permanent, and discriminating characters in their form, magnitude, or articulation; in the form, magnitude, the inclination, or number of their processes: though where such a distinction is to be found, the cervical vertebræ on their lateral aspects are generally known by a passage for the two vertebral arteries; the dorsal vertebræ, by articular surfaces, where they had been connected with the ribs; the lumbar vertebræ, by the want of these characters; the sacral vertebræ, by a general anchylosis, while the flatness of their bodies on the sternal aspect will distinguish them from the

lumbar, where these are naturally anchylosed, as in birds; and their transverse processes again from the lumbar, where the lumbar are anchylosed by disease, as not unfrequently happens in the horse. The coccygeal vertebræ in man have no canal resembling that of the spinal marrow, and consequently are destitute of both articular and spinous processes. The coccygeal vertebræ in birds have both spinous and transverse processes, and very nearly as free a motion as the vertebræ of the neck, but want a lateral passage for arteries. The distal coccygeal vertebiæ in quadrupeds are without a canal, and have somewhat of a cylindrical appearance; yet in many the vertebræ which are nearest the sacrum have not only a canal, but regular spinous and transverse processes, the articular being wanting or very indistinct.

In different animals the os coccyx has different uses. In man it contributes to support the rectum and viscera of the pelvis; in many birds, where long and broad feathers are attached, it serves to direct their course in the air, particularly in raising and depressing the atlantal extremity of the trunk. Some quadrupeds use it as a whip to defend themselves against troublesome insects; some as a hand to lay hold of an object when securing their position in walking on branches, in suspending their bodies, or in springing from one tree to another. The grehound uses it in balancing himself when running rapidly, or in turn-

ing suddenly to right or left; the kangoroo uses it to assist his two sacral extremities in sitting and leaping. In short, animals, according to form, structure, and circumstance, use it in a great variety of ways: for defence and attack; for balancing the body; for directing, accelerating, and retarding their motions; and for assuming and preserving their attitudes. Nor are these the only uses that are known. By its motions and changes of relative position that accompany desires, appetites, and passions, it even becomes an index of the feelings by which the animal at the time is actuated; and when it is furnished with hairs or feathers, the same feelings are also expressed by different arrangements of these appendages, which, in cases where they seem an incumbrance, are at least found to be highly ornamental, and probably, were our views less limited than they are, would also be found to have a relation to many of the more important functions that are secretly going on in the system.

The difference of sex in the human species occasions little difference as to the skeleton; and that difference is scarcely perceived till the age of puberty, when the female pelvis is somewhat more than proportionally enlarged, the femora removed to a greater distance, and other corresponding changes induced in the sacral extremities, that assist the female more easily to regulate the centre of gravity. The other differences ascri-

bed by Soemmerring to the female skeleton are chiefly some marks of resemblance which it retains of the fœtal skeleton. It has been the will of the Author of Nature, that the head, neck, and atlantal extremities should be proportionably larger in the fœtus than in the adult; and this will has been accomplished by a greater degree of specific gravity bestowed on the head. Hence the head is always most dependent in the liquor amnii, and the force of the heart in propelling the blood towards that part constantly assisted by the power of gravitation. In this early state the thorax is small, from the want of respiration, and from the greater proportional bulk of the liver and intestines; the intestines not being evacuated when *in utero*; and the liver, besides receiving the blood of the vena portarum, receiving likewise the greatest part of what is returned from the placenta. At the moment of birth matters are changed; respiration commences; an expansive power is made to operate regularly on the thorax. From a change of function, placental blood is no longer returned to the liver. This organ gradually loses its proportional magnitude, while a change of posture removes its pressure, and that of the intestines, from the lungs and the diaphragm; causes gravitation to resist the blood in flowing to the head and atlantal extremities, but makes it co-operate with the force of the heart in propelling it to the pelvis and sacral extremities; which now, having no umbilical arte-

ries to diminish the current or its momentum, are found to increase rapidly in their turn, until they arrive at the destined proportions of the adult. The farther changes, and the extent to which they may be carried in advancing to maturity, will depend much on the frequency and vigour with which the different muscles are exerted in performing their share of the different functions, respiration, digestion, circulation, secretion, nutrition, &c. Proportioned to this frequency and vigour of exertion, the bones will be more or less marked by the muscles; and proportioned to the changes of circumstance and action, the general appearance and proportions of the skeleton will deviate more or less from that of the fœtus: to which skeleton we should always have recourse in explaining the greatest number of differences that exist between the male and female skeletons of the more advanced periods of life.

CHAP. IV.

OF THE MOTIONS OF THE TRUNK ON THE HEAD, NECK, AND THE FOUR EXTREMITIES.

THE motions of the trunk on the head and neck are performed by exactly the same muscles that move the head and neck on the trunk *, with this difference, that the fixed points are changed. Whence the muscles, as to the sacral and atlantal aspects, draw their now moveable points in directions opposite to those of their points that were formerly moveable; and the muscles that rolled the atlas dextrad on the vertebra dentata, now roll the vertebra dentata sinistrad on the atlas. In other respects the dorsal muscles still inflect dorsad; the sternal, sternad; and the lateral, laterad: those which are motors being always moderated by the muscles occupying the opposite aspect, and direct-

* See p. 313. 316. 318. 320.

ed by those which occupy the two aspects that remain. The same observations, with a change of language, may also be extended to the several muscles of the extremities: for, whatever be their moveable or fixed points, the same muscles always continue to perform the like office as flexors, extensors, adductors, abductors, rotators; and when acting in any capacity as motors, have, in that capacity, at all times the same moderators and the same directors.

By the motions of the head, neck, and extremities, the trunk, independent of its own proper motions, may be pushed from an object, or drawn towards it; moved upwards, downwards, backwards, forwards; to the right, or to the left; or, combining with these its own proper motions, may be whirled round on the heels like a top, rolled on the ground in the manner of a cylinder; or, heels over head, be made to turn like the wheel of a chariot rolling on its axis. Thus, by nameless and numberless combinations of flexions, extensions, adductions, abductions, rotations, varying as to force, number, and extent; or as to velocity, the periods of duration, and orders of succession, the human body may exhibit phenomena calculated to astonish the myologist himself, and may force him to acknowledge that the muscular system, as varied by disease, habit, study, and original bias, may, in both its voluntary and involuntary functions, produce ef-

fects of which he has not formed, and possibly may never be able to form, any adequate conception.

CHAP. V.

OF THE MOTIONS OF THE ATLANTAL EXTREMITIES.

THE motions of an atlantal extremity are those of its clavicle, scapula, humerus, ulna, radius, carpus, metacarpus, and digital phalanxes; which several motions taken collectively, and yet as confined to those particular lines of direction that, by way of eminence, come to be noticed in the following sections, will, independently of any other motions, and of all the varieties necessarily resulting from a difference of force, velocity, extent, and order of succession, amount to at least seventy and upwards.

SECT. I.

MOTIONS OF THE CLAVICLE.

THE motions of the clavicle are,

Atlantad,
Sacrad,
Sternad,
Dorsad,

or combinations of these motions. The muscles which perform them are of two kinds; those which act directly on the clavicle, and those which move it by acting through the medium of the scapula and sternum. Of the first kind are the

	Directions of action.
Subclavius *,	Sac. ster. mesiad.
Pars sterno-cleido-mastoidei *,	At. dor. laterad.
Pars trapezii, seu cucullaris *,	At. dor. mesiad.
Pars pectoralis *,	Humerad.
Pars deltoidis *,	Humerad.

The other muscles will be enumerated in treating of the motions of the scapula and sternum. It is from the articular connections of the clavicle with these two, and from its muscular connections with the head, that it is so difficult, in cases of fracture, to preserve its separated parts in contact, and to guard sufficiently against the

* See page 186.

circumstances that retard the union. It is true, the particular situation of the fracture may occasion some difference, according as the part where it chances to be is subjected to motion more or less extensive; but, be the motion extensive or not, some degree of motion is next to unavoidable: the motions of the head are insensibly induced by the objects around us attracting the senses; the motions of the sternum are intimately connected with those of respiration, which is constant, from instinct; while those of the scapula, as connected with the humerus, are not only frequent but extensive, from habit: and yet after all a luxation of the bone is more to be dreaded even than a fracture. From its being susceptible of very little motion distinct from that of the scapula and sternum, and the motions of these but seldom corresponding in extent and direction, if luxated at either of its two extremities, the ligaments, from the weakness of their vital energy, cannot soon be restored, while all the causes that retard the union in cases of fracture operate more powerfully in those of luxation. And, hence, it has probably been with a view to prevent such an accident, that the *pectoralis* and *sterno-cleido-mastoideus* at the one extremity, and the *cucullaris* and *deltoides* at the other, have been made each to extend their attachments across these joints, in order that the two extremities of the clavicle might be regularly moved along with the bones with which they are articulated,

their relative situations so far preserved, the joints strengthened, the motions performed, and luxation in ordinary cases prevented. When that does occur, the greatest inconveniency is always felt when it occurs at the acromion, whose motions are extensive. In a certain case, I have seen it for three years now at the sternum occasionally and slightly obstructing the extent, vigour, and steadiness of the motions of both the scapula and humerus, but at no time preventing them entirely, except when the parts were morbidly sensible.

SECT. II.

MOTIONS OF THE SCAPULA.

In most animals where clavicles are wanting, the scapulæ lie on the lateral aspects, the heads pointing sternad, the bases dorsad, and the ribs, from the two opposite sides of the vertebral column, tending, as they meet, through the medium of their cartilages, to form an acute angle at the sternum. Where clavicles are present, the heads of the scapulæ are removed farther from the mesial line, the thorax is rounder, the atlantal extremities placed at a greater proportional distance, and susceptible of a greater variety of motion. In man, where the clavicles, with the intermediate bone of the sternum, greatly exceed that diameter of the trunk where they are situated, the two scapulæ

are removed from the lateral aspects to the dorsal, and with their heads pointing atlantad, laterad, mesiad, and sternad, and their bases sacrad, mesiad, and dorsad, admit of a certain change of situation, not only in directions atlantal and sacral, but stermesi-lateral and dorsa-mesial. The Humeri also, from this position of the two scapulæ, may not only be moved atlantad and sternad, but stretched in abduction directly laterad, or inflected dorsad till their distal extremities shall meet opposite to the mesial plane. The advantage, therefore, of the two clavicles is to afford the atlantal extremities a greater variety and latitude of motion, as may be seen in all the red-blooded animals that fly; and if it be true that certain animals can, without clavicles, lay hold of objects with the digital phalanxes of these extremities, and can use them occasionally to climb, dig, or rake the ground, it is also true that the animals which have clavicles, and which are disposed for similar operations, can, *cæteris paribus*, perform them with more apparent facility, and in a greater variety of ways.

The motions of the scapula are,

Atlantad,
Sacrad,
Ster-mesi-laterad,
Dorsa mesiad,
Rotatory,

or combinations of these motions.

In moving sternad, as it cannot reach to the

mesial plane on account of the clavicle, it must follow a direction that is ster-mesi-lateral; and when its base approaches that plane on the dorsal aspect, compelled by the ribs, it must move in a course that is dorsa-mesial. Its rotatory motions are, when it rolls, as it were, on an axis perpendicular to its plane, when its acromion is moved atlantad and its base sacrad; or, *vice versa*, the base atlantad and acromion sacrad at the same time; or when it rests on the ribs as on a fulcrum, with its head and base alternately approaching, and alternately receding, from the peripheral aspect of the thorax.

The muscles by which these motions are performed are the

	Directions of action.
Trapezius *,	At. dor. mesiad. Dor. mesiad. Sac. dor. mesiad.
Rhomboidei *,	At. dor. mesiad.
Levator scapulæ *,	At. ster. laterad.
Serratus anticus *,	Sac. ster. mesiad.
Serratus magnus *,	Sac. ster. laterad.

assisted occasionally, through the medium of the humerus, by the

Latissimus dorsi †,	Sac. dor. mesiad.
Pectoralis †,	At. ster. mesiad. Sac. ster. mesiad.

* Vide scapulæ, p. 186.

† Vide claviculæ, p. 187.

and, through the medium of the clavicle, by the
Subclavius *, Sac. ster. mesiad.

In attending to the directions of their action, the reader, it is hoped, will not forget that it is here, as every where else, each muscle belonging to a group, and acting in the same general direction, acts notwithstanding in a direction specifically its own: Or, in other words, every general direction of action is more or less specifically varied by each muscle that acts in that same general direction.

The BASE is moved Sacrad,
The ACROMION, Atlantad,
The WHOLE, Dorsa-mesiad,
by the trapezius.
The BASE, Sacrad,
Sternad,
Laterad,
by the serratus magnus;
Atlantad,
Sternad,
Laterad,
by the levator scapulæ.
The ACROMION, Atlantad, &c.
by the trapezius;
Sacrad,
Sternad,
Mesiad,
by the serratus anticus, and the pectoralis (costen and sternen portions †);

* Vide humeri, p. 188.

† The claviculen portion of the pectoralis being unable to

Sacrad,
Dorsad,
Mesiad,
by the latissimus dorsi;
Sacrad,
Sternad,
by the subclavius.

When the acromion is drawn sacrad, sternad, and mesiad by the *pectoralis* and *serratus anticus*, it is always brought in the mesial direction nearer to the ribs; while the base, receding both from the ribs and the mesial plane, projects in a line more directly dorsad. On the other hand, when the base is drawn to the mesial line on the dorsal aspect by the *trapezius*, by the two *rhomboidei*, and by the *latissimus*, which must always act through the medium of the humerus, the base is observed to approach the ribs, while the acromion is seen receding laterad and dorsad. In these motions the scapula rests on the side as on a fulcrum, with its head and its base moving, like the two extremities of a balance, in opposite directions. These changes may easily be perceived when the humerus is abducted, considerably elevated, and moved alternately sternad and dorsad; or they may be perceived in attempting to touch the base of the scapula with the fingers belonging to

affect the acromion, as it indirectly derives its fixation from the muscles of the scapula.

its own extremity, and afterwards in bringing the humeri to meet, or the two fore-arms to cross one another on the dorsal aspect.

As none of the motions belonging to the scapula are ever performed by a single muscle, when the scapula is moved directly atlantad, the atlantal forces acting on the base and acromion are the *motors*, the dorsa-mesial and ster-mesi-lateral the *directors*, and the sacral forces the *moderators*; when moved sacrad, the same forces continue the *directors*, the atlantal forces become *moderators*, and the sacral the *motors*.

When it is moved dorsad and mesiad, the dorsa-mesial forces are the *motors*, the atlantal and sacral the *directors*, and the ster-mesi-lateral the *moderators*; the mesial forces in these cases being moderated by the ribs. When moved in the ster-mesi-lateral direction, the ster-mesi-lateral forces are the *motors*, the atlantal and sacral continue the *directors*, and the dorsa-mesial become the *moderators*.

When it rolls on an axis perpendicular to its plane, when the base is elevated, and acromion depressed, or, *vice versa*, the atlantal and sacral forces of the base and acromion become alternately *moderators* and *motors*; the dorsa-mesial and sterna-lateral, in these cases, being always the *directors*.

In these motions, where it moves like a balance as it rests upon the side, the sacral and atlantal

forces are *directors*, the dorsa-mesial and ster-mesi-lateral alternately the *moderators* and *motors*.

When the scapula is fixed, and the trunk moveable, the fixed points of the muscles being changed, the directions of their action will be the opposite of what they were when they moved the scapula.

When the scapula is meant to form a steady support for the humerus, its antagonist muscles are made to act with an equal force, or to moderate one another with the steadiness required.

When the humerus is brought to nearly a straight line with the spine of the scapula, and the humerus and spine preserved in the same relative position, that rolling of the scapula, where the base is drawn sacrad and sternad, and the acromion atlantad and dorsad, will bring the humerus to a line nearly parallel to the axis of the trunk. In short, that motion where the elbow or distal extremity of the humerus is brought to a level, or nearly to a level, with the crown of the head, can never be performed without the rotatory motion of the scapula.

In mentioning the uses of the *serratus magnus* and *levator scapulæ*, Winslow maintains, that those muscles which depress the base elevate the acromion, and *vice versa*. In examining the rotations, I have seen indeed that those muscles which depress the base and those which are destined to elevate the acromion, are made to act at the same

time; but I have not seen the depression and elevation follow one another as necessary consequences; nor can I possibly conceive how they should, as the rotation is round only an imaginary axis. Albinus is silent as to this opinion of the justly esteemed and celebrated Winslow; and as to another opinion of Winslow's, that this *serratus* can never be a muscle that assists inspiration, Albinus supposes, that when the scapula in its usual situation is a fixed point, the seven atlantal heads of this muscle depress the ribs to which they are attached; because, in following a course nearly similar to that of their ribs, they happen to form an acute angle with their sacral margins. The consequence, however, and it cannot be denied, must be somewhat different when the scapula is elevated; and Haller found that this elevation regularly took place in laborious respiration.

SECT. III.

MOTIONS OF THE HUMERUS.

In describing these motions, we shall have but little use for the terms denoting the several aspects of the trunk; and as the directions of muscular action may here be inferred from the attachments and functions described, it will scarcely be necessary to deviate from our plan by here introducing myographical narration, and mentioning in detail

those fasciæ and ligaments required only in particular circumstances to prevent inordinate degrees of relaxation, or too great changes of relative position. It may be sufficient to observe in general, that these principally belong to muscles that have a number of functions to perform, or actions to moderate, and more especially if the muscles be connected with two or more joints that admit of varied and extensive motion; in which cases the tension of the fasciæ, which are made to answer the purpose of bandages, is frequently regulated by carneous fibres attached to them either by origin or insertion.

The motions of the humerus are those of

Extension,
Flexion,
Abduction,
Adduction,
Rotation,

or combinations of these motions;—

Extension carrying the humerus sternad;
Flexion, dorsad;
Abduction, laterad;
Adduction, mesiad; and
Rotation turning it round on its axis.

This last motion is of two kinds. When the arm is extended, and the palm of the hand is made to rest on the side of the thigh, that motion which in the fore-arm is called *supination*, and by which the thumb is turned outward or laterad, is rotation *radiad*, and the contrary motion rotation *ulnad*. These rotations may be performed in a state of ex-

tension, flexion, abduction, or adduction; as abduction and adduction may be performed in a state either of extension or flexion, and, *vice versa*, extension and flexion, in a state either of abduction or adduction.

The muscles by which these functions are performed, are the

Deltoides *,
Biceps brachii *,
Coraco-brachialis *,
Supraspinatus *,
Infraspinatus *,
Teres minor *,
Teres major *,
Latissimus dorsi *.
Pectoralis *,
Caput longum tricipitis brachii *.

The extensors are the

Deltoides (acromien and claviculen portions),
Supraspinatus,
Infraspinatus,
Subscapularis,
Biceps brachii,
Coraco-brachialis,
Pectoralis (claviculen portion).

The *spino-scapulen* portion of the deltoides is a flexor; the functions of the *supraspinatus* can hardly be mistaken; and as for the *infraspinatus* and *subscapularis*, they are both extensors in a small degree when the humerus is elevated in a plane

* See page 188.

parallel to that of the scapula; though when it is rolled radiad or ulnad, the power of the one will be necessarily increased proportionally as that of the other is diminished; the length of lever, and degree of contractility in any given action of a muscle depending on the change of relative situation, and the other functions in which it is concerned.

The *biceps*, which I have oftener than once seen receiving a third head from the humerus, being a flexor and supinator of the fore-arm, and at the same time a tensor of its fascia, its effects on the humerus, upon which it acts only indirectly, will be partly modified by the changes in the relative position of the radius; its head, from the margin of the glenoid cavity, when rolled radiad along with the humerus, becoming more powerful as an abductor, and in some measure a rotator ulnad.

The whole of the *pectoralis* is an adductor, and if not resisted by the flexors and abductors, and particularly by the *latissimus dorsi*, would draw the humerus sternad and mesiad as far as the sternum, or even beyond it. As the humerus, however, during extension, is moved in planes extending from the mesial to the dorsal aspect; and as all these extensors, excepting the pectoralis, are likewise calculated to move it in planes between the mesial and lateral aspects, they in all cases would produce abduction as well as extension, were they not moderated by the adductors.

The flexors are the

Deltoides (spino scapulen portion),
Teres major,
Teres minor,
Triceps brachii (long head of),
Latissimus dorsi.

Should any be surprised why the *teres minor* is here enumerated among the flexors, and the *infra-spinatus* among the extensors, considering that they are so closely united in their origin, their course, and their termination, that Vesalius has described them as one muscle, it may be observed, that two parts of the same muscle may have different functions; or, indeed, without any reasoning or hypothesis, that one of these muscles is actually relaxed while the other is stretched during extension; an effect that could not possibly arise from any other cause than from their acting at the same time on opposite sides of the centre of motion, just as two cords attached to a balance supported upon the edge of a knife, will, if they be drawn towards the knife, move the balance in opposite directions, although they be parallel and almost in contact, with nothing but the edge of the knife interposed.

To prevent mistakes. I must here add, that all the extensions and flexions of the humerus, as may be seen in the living body, are regularly accompanied with corresponding motions of the scapula: the base moving sternad, and the acromion dorsad, during the extensions; and *vice versa*, in contrary directions during the flexions, if these be

performed in a state of adduction, or in a plane nearly parallel to the mesial plane. If performed, however, in a state of abduction, the scapula is seen moving alternately dorsa-mesiad and ster-mesilaterad, with its middle part pressing on the thorax, and its head and its base moving like the two extremities of a balance, alternately approaching and receding from the ribs.

The abductors are the

Deltoides,
Supraspinatus,
Infraspinatus,
Subscapularis,
Biceps brachii,
Coraco-brachialis.

It already has been noticed, that all the extensors, except the *pectorales*, are calculated to move the humerus laterad, or, in other words, in a plane approaching to that of the scapula; and would consequently, therefore, produce an abduction, were they not restrained by the adductors. From this circumstance, the enumeration of the extensors and of the abductors is nearly the same, with the difference only, that the spino-scapulen portion of the deltoides, from being a flexor, is not enumerated among the extensors, nor the claviculen portion of the pectoralis among the abductors.

The adductors are the

	Directions of action.
Pectoralis,	At. ster. mesiad. Sac. ster. mesiad.
Latissimus dorsi,	Sac. dor. mesiad.

When these two act with equal forces sternad and dorsad, they will move the humerus at right angles to the mesial plane; or if one of them act, as the pectoralis, and draw the humerus till its distal extremity meet the mesial plane at the sternum, the latissimus dorsi, by drawing dorsad, will press the distal extremity to the thorax. On the other hand, if the humerus be drawn mesiad and dorsad by the latissimus, its distal extremity will be pressed to the dorsal part of the thorax by the pectoralis. None of these motions can, however, be performed without corresponding motions of the scapula, whose head, excepting in the rotatory motions, generally follows to a certain extent the motions of the humerus.

When the extensors, the abductors, the flexors, and the adductors act to the same degree of extent, and also in the same order of succession in which they are inserted around the humerus, the humerus will describe the circumference of a cone, the base of which is towards the elbow, and the apex of which extends to the scapula; the pectoralis moving the whole

Sacrad,
Mesiad, and
Sternad;
Then, Sternad,
Mesiad, and
Atlantad,

till it come within the sphere of the extensors and of the abductors, which will move it

Atlantad,
Laterad, and
Dorsad ;

and then deliver it over to the flexors, which will move it

Dorsad,
Mesiad, and
Sacrad ;

until it again come within the sphere of the pectoralis, which will move it round as it did before.

This compound motion will serve to explain, why part of the adductors should be extensors, why part of the extensors should be abductors, why part of the abductors should also be flexors, and why the flexors should naturally run into part of the adductors. In such a motion, it must be obvious, that the motor forces in any given part of the circle will always be moderated by those which are opposite, and directed by those that act in a plane at right angles to the moderating forces.

The rotators radiad are the

Supraspinatus,
Infraspinatus,
Teres minor,
Deltoides (spinoscapulen portion), and the
Coraco-brachialis (to a small extent, and only when the humerus has been rolled ulnad).

The rotators ulnad are the

Subscapularis,
Deltoides, (claviculen portion) ;

and when the humerus has been rolled radiad, the

Latissimus dorsi,
Teres major, and
Pectoralis (to a small extent, however, and only at the commencement of the rotation).

In rolling the arm, the rotators radiad co-operate with the muscles called supinators; the rotators ulnad, with the pronators. To know, therefore, the extent of motion which is produced by the different rotators, let the humerus be held close to the side; and after pronation and supination have taken effect to their fullest extent, let the arm be extended in a state of abduction, and with the eye directed to the hand examine how much of rotation is added by the muscles of the humerus, it will be found that the radial rotators add very little; the ulnar rotators often a semicircle.

Considering the great variety of functions which the muscles belonging to the joint at the shoulder have to perform, and considering likewise that each of these muscles performs the different functions assigned to them in different degrees, it often requires no small share of attention and accuracy to demonstrate clearly their more obscure and subordinate functions. Let us take, for instance, the spino-scapulen part of the deltoides, which is a flexor, an abductor, and rotator radiad. The method usually adopted by anatomists to ascertain the particular motions which this or any muscle had performed in the living body, is to preserve its relative situation with all the connections that

affected its functions, and then to try, by moving the bone in different directions, to discover those particular positions in which the fibres are stretched or relaxed. Now the fibres of this part of the deltoides may be relaxed in a state of abduction, flexion, or rotation, and the humerus may be placed in all these states at the same time; the difficulty then will be, to ascertain what particular degree of relaxation was occasioned individually by the separate states. To know, for example, the degree of relaxation from rotation radiad, or whether any relaxation is produced, the humerus must previously be rolled ulnad, and then radiad, without either abduction or flexion, and without any change in the previous state of extension or adduction; for if abduction or flexion take place, a relaxation may be ascribed to the rotation, which does not belong to it; or if farther extension and adduction take place, the relaxation which would follow as a consequence of the rotation might be prevented. In short, the anatomist, in designing to produce a simple motion, may inadvertently produce a compound, and ascribe the effects which he afterwards sees to the motion which he had intended to perform; although the effects be the consequences of a motion which he never had intended, and of which he might never have formed an idea. In making these remarks, let it not be supposed that I allude to the errors of others. The diffidence I feel, and the caution I have learn-

ed in examining muscles with a view to ascertain the nature of their functions, have chiefly arisen from comparing my later and earlier observations, and from detecting instances, not a few, of my own inadvertency and want of attention to minute circumstances, that are apt to escape the notice of a person not practised in conducting these kinds of experiments.

In those cases where the humerus is luxated, a steady attention to the situation in which it is placed, and deliberate reflection on what muscles are relaxed and stretched, what muscles are ready to assist or oppose, and likewise what muscles, s for instance the biceps, may be affected by the flexion or extension of some other joints, must always be objects of importance with the surgeon; and if he should wonder, in attempting the reduction, at the varied, sudden, and vigorous exertions which are made by these muscles, and at the great unavailing force that is not unfrequently made to overpower them, he surely cannot help being equally surprised at the slight causes which in some instances produce the luxation, and the small force which in other instances is required in the reduction. To explain the phenomena, we have only to reflect that the bone is preserved in its situation chiefly by the muscles, and that when any of the powerful muscles are taken by surprise, and without the others being prepared to moderate and direct it, the joint must always be in danger of luxation,

however trifling be the force or the stimulus that introduced the derangement of action. The same is the case after luxation: the surgeon, taking the patient by surprise, may often with a slight and a sudden jerk throw those particular muscles into action which favour the reduction, before the muscles calculated to oppose them are prepared to make any forcible resistance. Thus may a slight force, properly contrived and accurately timed, do more at one period than a great force directed by skill can do at another. As a proof of this assertion, it is not the joints that have the most vigorous actions to perform, nor is it the joints that are least secured by the strength of their ligaments or by articulation, that are most liable to accidents of luxation; it is those joints which, like the joints at the hip and the shoulder, admit of the greatest variety of motion, which require the greatest variety of action in their muscular forces, and where harmony amidst this variety of action is most difficultly preserved, from the number of rotators, motors, moderators, and directors that must necessarily act at the same time with a precise and definite force, and yet may have other functions to execute on different bones and articulations*. Let it not be said, that in these cases the capsular ligaments perform not their

* See pages 301, 302.

office; for what, in general, is the strength of these capsules* where the muscles adhere to them? they are little more than cellular membrane; and if the bone usually burst through them where they are strongest, and where they are least supported by muscles, it will only prove that muscles are the principal security of the joint, as we may see in that connection formed between the trunk and scapulæ of quadrupeds, without the intervention of clavicles.

SECT. IV.

MOTIONS OF THE ULNA.

THE motions of the ulna are those of

Extension,
Flexion,
Rotation:

In the two first, accompanied by the radius; in the last, by the humerus.

The connection of this bone with the radius is formed by ligaments; at its proximal extremity, by the capsular membrane, the *ligamentum orbiculare*, and *chorda transversalis*; from near its proximal extremity to the distal, by the *membrana interossea*; at the distal extremity, by that ligamento-

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* See pages 304, 305.

cartilaginous substance which Weitbrecht denominates *cartilago intermedia* or *triangularis*, by the *membrana capsularis sacciformis*, and by those ligaments which extend from the styloid processes of each bone, and there connect them, although indirectly, through the medium of the carpus. This connection is farther strengthened by the *fascia* of the biceps, and the other *fasciæ* expanded peripherad over the muscles, collecting the whole, as it were, into a group, firmly attaching themselves to the bones, and affording an origin to several fibres belonging to the muscles. Lastly, it is strengthened by the muscles themselves, and in different ways: by some of them adhering to the capsular membrane at the proximal extremity of the two bones; by others being attached to the two bones *; and again by others which, though attached but to one of the bones, yet run from the ulnar to the radial aspect obliquely across the interosseous space, as may be seen in some of the pronators on the thenal aspect, and in some of the extensors upon the anconal. From such powerful connections, the radius being forced to accompany the ulna, both in its motions of extension and flexion, the same muscles that explain the extension and flexion of the one will explain the extension and flexion of the other.

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* See page 189.

Common Extension of the Ulna and Radius.

This motion is produced by the

Triceps brachii, and
Anconeus;

none of which are inserted in the radius.

With respect to the long head of the triceps, it being also a flexor of the humerus, it will act less forcibly upon the ulna, when the humerus is extended, than when it is inflected; and, consequently, in cases where the ulna is luxated, and where the olecranon is drawn proximad upon the anconal aspect of the humerus, in attempting the reduction, the humerus should be brought to a state of flexion.

Common Flexion of the Ulna and Radius.

This motion is produced by the

Brachialis internus,
Biceps brachii,
Supinator longus,
Ulnaris internus,
Palmaris longus,
Pronator teres,
Radialis internus,
Sublimis.

The biceps, from being an extensor of the humerus, will in this instance act with more force when the humerus is inflected than when it is extended, and will, at the same time, meet with a less degree

of resistance from the moderating force of the long or scapulen head of the triceps*.

The *ulnaris internus*, and the muscles that follow, are flexors only to a small extent, and only at the time when the motion commences, before the lever of resistance is shortened, and the levers of the biceps and supinator are lengthened †; the four last having their power a little increased when the arm is placed in a state of supination, and when, consequently, the biceps is somewhat relaxed.

The office of directors is here committed to the structure of the joint, to its accessory ligaments, to the fasciæ, and to those muscular attachments that are situated on its radial and ulnar aspects.

Rotations of the Ulna.

From the structure of the joint by which the ulna and humerus are connected, it not only is obvious, but proved by experiment, that a rotatory motion in one of these bones, if the ulna be extended, must be necessarily followed by a like rotatory motion in the other. It is also obvious, and proved by experiment, that the rotatory motions observed in the hand proceed from the rotatory motions of the radius. Supposing, then, that the hand takes firm hold of an object that is not to be

* See page 295.

† See page 288 and 294, 295.

moved by its muscular force, the rotations of the radius will be prevented, though the ulna, if extended, may be made to roll along with the humerus. Yet in these circumstances the humerus will be rolled, not merely by the muscles inserted near its proximal extremity, but partly also by the pronators and supinators, some of which are attached to the humerus, and some to the ulna; the pronators rolling them thenad and radiad, and combining their effects with those resulting from the supraspinatus, the infraspinatus, the teres minor, and the spino-scapulen part of the deltoides; the supinators rolling them again radiad and anconad, and combining their effects with those resulting from the teres major, latissimus dorsi, the pectoralis, the claviculen portion of the deltoides, and subscapularis.

If, after all, it should be observed, that the rolling of the ulna in these circumstances is rather obscure, the answer may be, that it is partly owing to the ligament that extends from its styloid process to the carpus, which is then a fixed point, and partly also to those extensors, and to those flexors of the carpus and fingers, which are then employed in another function, that forces them to oppose rather than to favour this kind of motion. In such cases, the resistance is communicated even to the humerus; and hence it is, that we never can roll the ulna or humerus to the same extent, when the hand is fixed, as when it is totally free and disengaged.

Rotations of the Radius.

These rotations are already well known under the names *pronation* and *supination*.

The pronators are the

Pronator teres,
Pronator quadratus,
Palmaris longus,
Radialis internus,
Sublimis:

The three last at only the commencement of the pronation, although their power, from being thenal flexors of the carpus, be somewhat increased in cases where the hand is inflected anconad, and that of the sublimis farther increased where the fingers are extended.

The supinators are the

Biceps brachii,
Supinator brevis,
Extensor major pollicis:

The first acting with the greatest force when the humerus is inflected; and the last, with the greatest when the carpus and thumb are inflected thenad.

As for the muscle which has been called *supinator longus*, it co-operates with, and moderates alternately, pronators and supinators, bringing the radius to that middle state which is properly neither pronation nor supination, and performing this office with the greatest force when the arm is extended.

General Remark.

In both these kinds of rotatory motion, as the radius must necessarily roll on the ulna, we never can suppose that the radius can roll, and particularly at its distal extremity, on its own axis; nor ever suppose, considering the connections of the ulna and carpus, that the carpus can roll along with the radius, and the ulna remain stationary in its place. In every pronation, therefore, and supination, these two bones at their distal extremity twist, as it were, round a common axis*. Not, however, that the ulna is susceptible of rotation at its junction with the humerus, but only of a certain freedom of motion sufficient to allow its distal extremity to follow the carpus in pronation and supination.

From such an account, it is not improbable that all these muscles which run obliquely from the radial to the ulnar, or from the ulnar to the radial aspects, may have some effect on these rotatory motions, though not so extensive as to be demonstrable in the dead body.

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* On attribue pour l'ordinaire ce mouvement au rayon seul. On s'imagine que l'os du coude n'y a aucune part, et on ne regarde cet os que comme une piece qui sert uniquement d'appui et de base sur laquelle on fait faire au rayon ces petits tours reciproques qu'on appelle pronation et supination. Enfin, on

SECT. V.

MOTIONS OF THE CARPUS.

THESE consist of different inflections,

Anconad,
Thenad,
Radiad,
Ulnad;

or in any of the intermediate directions. The motion anconad has been called *extension*, as being

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borne ce mouvement à l'action de quatre muscles, ou tout au plus à cinq, en y rapportant le biceps.

On prétend même avoir vû montrer, avoir soi-meme montré, et être toujours en état de montrer clairement et d'une maniere incontestable, tant sur le squelette que sur le cadavre, ces deux mouvemens reciproques, sans aucun mouvement de l'os du coude. De plus, sur cette idée, on a souvent, avec une pleine assurance, et en public et en particulier, fait ces mouvemens sur soi-même; pour prouver qu'ils se font avec le rayon sur l'os du coude, et que l'os du coude n'y a aucune part.

J'ai néanmoins observé, et je l'ai démontré à l'Academie Royale des Sciences, que dans ces mouvemens libres, et faits sans contrainte, comme autour d'une axe commun, les deux os de l'avant-bras se meuvent toujours en même tems; c'est-à-dire, par exemple, pendant qu'on tourne le rayon vers la poitrine par la pronation, on en éloigne en même tems l'os du coude; et reciproquement, quand on éloigne le rayon par le mouvement de supination, on en approche en même tems l'os du coude. J'entends ceci dans l'attitude de l'avant-bras fléchi. *Winslow, Exposition Anatomique de la Structure du Corps Humain*, ii. 485.

opposed to the motion thenad, which has been simply denominated *flexion;* while the directions radiad and ulnad have been differently expressed by different authors, according to that particular attitude in which they have chosen to describe the forearm. When they have chosen to describe it as extended, and either parallel or inclined to the trunk in a state of pronation, their motion radiad has been motion *inwards*, and that towards the ulna, motion *outwards;* or when they have preferred a state of supination, their motion radiad has been motion *outwards*, and that towards the ulna, motion *inwards*; or when, with Albinus, they have preferred a state intermediate, their motion radiad has been motion *forwards*, and that towards the ulna, motion *backwards*. Thus have the terms *anterior* and *posterior*, *interior* and *exterior*, with the adverbs corresponding, been each employed to denote three aspects of the forearm; while the term *abduction*, as applied to the thumb and the little finger, is still used to express motions in opposite directions; a similar privilege, if such it may be called, having been conferred on its relative adduction.

The muscles employed in performing these motions, are the

Radialis externus longior *,
Radialis externus brevior *,
Radialis internus *,

* See p. 189.

Ulnaris externus *,
Ulnaris internus *,
Extensor communis digitorum *,
Indicator †,
Extensor proprius minimi digiti *,
Abductor longus pollicis ‡,
Extensor minor pollicis ‡,
Extensor major pollicis ‡,
Flexor longus pollicis ‡,
Palmaris longus *,
Sublimis *,
Profundus †.

The inflectors anconad, are the

Radialis externus longior,
Radialis externus brevior,
Extensor major pollicis,
Indicator,
Extensor communis digitorum,
Extensor proprius digiti auricularis.

The inflectors thenad, are the

Radialis internus,
Ulnaris internus,
Palmaris longus,
Sublimis,
Profundus,
Flexor longus pollicis.

Yet the two first muscles in each of these classes being chiefly employed in the motions of the carpus, they in this respect differ considerably from the other muscles, which, besides inflecting the carpus, inflect some of the digital phalanxes, and consequently act with more or less force in

* See p. 189. † P. 190. ‡ P. 191.

moving the carpus, as their contractility is more or less exhausted by previous functions.

From the centre of motion being in the carpus, as everywhere else, confined to a very limited space, and from some of these muscles not lying directly anconad or thenad, but somewhat to the radial or ulnar aspects, they, in bending the carpus anconad or thenad, must likewise inflect it either radiad or ulnad.

The inflectors radiad, are the

Abductor longus pollicis,
Extensor minor pollicis,
Radialis externus longior,
Radialis externus brevior,
Radialis internus.

The inflectors ulnad, are the

Ulnaris externus,
Extensor proprius minimi digiti,
Extensor communis digitorum,
Ulnaris internus,
Sublimis,
Profundus;

the *abductor longus* and *extensor minor pollicis* appearing to have no sensible effect on either the motions anconad or thenad, while the *ulnaris externus* seems to bring the hand from the extremes of these two motions, and to carry it ulnad. The *indicator*, the *extensor major pollicis*, the *palmaris longus*, and the *flexor longus pollicis*, have not been introduced; as their effect in acting on the radial or ulnar aspect is, in ordinary cases, not very conspicuous.

SECT. VI.

MOTIONS OF THE BONES COMPOSING THE CARPUS.

These motions between any two bones are very obscure, if we except a small degree of motion between the *pisiforme* and the *cuneiforme*; the pisiforme being, as it were, a sesamoid bone belonging to the tendon of the *ulnaris internus*. The effects of the whole, even when combined, are not very perceptible, either when the hand is closed or expanded; and yet, imperceptible as they seem to be, they are not without their use. By these motions, by the lubricity of the articular surfaces, and by the elasticity of the accessory ligaments, the form of the carpus, so far as necessary, is regularly accommodated to the different functions of the metacarpal and digital phalanxes. At the same time, the smallness of the motion among the whole, and between any two bones, greatly assists in enabling them to preserve their relative positions; though, should it be asked, how are they able to preserve this position amid the shocks to which they are exposed? why they should be placed in such a situation? or why one bone would not have been preferable here to a number?—the answers may be, that their connections are not preserved merely by ligaments; that there is no vi-

gorous exertion of the hand, or its fingers, in which they are not regularly supported by fasciæ or tendons acting as motors, moderators, or directors; that some of these tendons proceeding from the forearm, run across them on their different aspects with different obliquities, some decussating, and some, like the fibres of the aponeurosis palmaris, diverging like radii from centre to circumference, and compressing them strongly upon every side, and distad, through the medium of the metacarpal and digital phalanxes; that in addition to this support which they derive from the muscles of the forearm, the *palmaris brevis** is always ready to give its assistance, while there is not a bone of the number, the *scaphoides*, *lunare*, and *cuneiforme* excepted, that does not afford an origin to muscles which by their action support them indirectly, and which by their attachment contribute directly to strengthen and assist their accessory ligaments. Had one bone occupied their place, its form could not possibly have been accommodated to all the varying motions of the hand, nor could such a bone have so readily diffused and rendered harmless those concentrated forces of concussion to which the carpus is so generally liable.

* Though this muscle be not attached to any bone, it seems to perform an office somewhat similar to that of the *transversus pedis*.

SECT. VII.

MOTIONS OF THE BONES COMPOSING THE METACARPUS.

THE metacarpus consists of five bones articulated with the distal row of the carpus, and employed to support the digital phalanxes of the thumb and the fingers. They are generally considered as forming a group like the preceding, and it must be acknowledged that the four of the group belonging to the fingers have but very little motion as distinct parts; for although it be true, that the *radialis internus* and the *radialis externus longior* are inserted into one of them, the *radialis externus brevior* into another, and the *ulnaris externus* into a third; yet they seem to be inserted, not so much with a view to produce any separate effect, as to move the whole at the same time, to support the carpus, and afterwards to inflect it upon the radius: the most obvious motion perceived in any of them is in that appropriated to the little finger; it is perceptibly moved by a muscle called its *adductor;* a muscle which prevents it from being too widely separated from the rest, and which draws it a little radiad and thenad. The other motions observed in these bones, and not accompanied with the motions of the carpus, seem chiefly to arise from the action of the muscles that are attached to

the digital phalanxes; muscles which not only in some measure regulate the form of this part of the metacarpus according to the nature of the functions performed, but also contribute to preserve its parts, as they did the several bones of the carpus, in their relative positions, though not with such a force as to suppress the freedom of the joints, or that elastic flexibility of the ligaments, so necessary in preventing the dangers arising from the concentrated forces of concussion.

The metacarpal bone of the thumb exhibits in its functions a more striking resemblance to the bones constituting the proximal phalanx of the four fingers, than to any of the bones with which it is classed; it is placed with its two digital phalanxes at some distance from the rest of the group; by which situation some of the muscles are made to enter the thumb less obliquely, and consequently to increase the lever of the power, while the want of a bone corresponding to the medial phalanx of the fingers shortens the thumb, and thereby diminishes the lever of resistance.

SECT. VIII.

MOTIONS OF THE SEVERAL DIGITAL PHALANXES.

In treating of the motions of the thumb and the fingers, a general observation may here be pre-

mised, that while distal phalanxes must necessarily accompany the motions of the medial, and the medial the motions of the proximal phalanxes, yet muscles inserted into distal phalanxes may be made, if required, to co-operate with the muscles of the same aspect that move the medial, and the muscles of the medial, in the same way, to co-operate with the muscles of the proximal phalanxes; whence, proximal phalanxes, independent of the shorter levers of resistance, may, in certain directions, be always inflected with a greater force than medial phalanxes, and medial phalanxes with a greater force than those which are distal.

Motions of the Thumb.

These motions are usually assigned to eight muscles:

The Abductor longus pollicis*,
Opponens pollicis*,
Abductor brevis pollicis†,
Adductor pollicis†,
Extensor minor pollicis†,
Flexor brevis pollicis†,
Extensor major pollicis†,
Flexor longus pollicis*.

The two first, with the abductor indicis manus, which should have been added to this number,

* See p. 194. † See p. 197.

being inserted into the metacarp; the next four, into the proximal; and the two last, into the distal phalanxes.

Motions of the Metacarp.

The motions of the metacarp by its own muscles, are

Radiad,
Thenad,
by the abductor longus;

Thenad,
Ulnad, and
Ulnad rotatory,
by the opponens pollicis;

Thenad,
Ulnad,
by the abductor indicis.

The motions of the metacarp and proximal phalanx by the muscles of the latter, are

Thenad,
Ulnad,
by the abductor brevis;

Ulnad,
Anconad,
by the adductor;

Ulnad,
Anconad,
by the flexor brevis;

Anconad,
Radiad,
by the extensor minor.

Motions of the Proximal Phalanx.

The motions of this phalanx, which are not necessarily extended to the metacarp, are *flexion* and *extension*, with a slight inflection to the *radial* and *ulnar* aspects of the thumb.

The flexion is performed by the

Abductor brevis,
Flexor brevis,
Adductor.

The extension, by the

Extensor minor, and
Extensor major;

assisted by the *flexor brevis* and the *abductor brevis*, which join them by lateral tendinous expansions.

The *inflection radiad*, by the *abductor brevis* and that portion of the *flexor brevis* inserted into the radial side of the phalanx.

The *inflection ulnad*, by the *extensor major* and that portion of the *flexor brevis* inserted into the ulnar side of the phalanx.

The motions of the metacarp and proximal phalanx, by muscles inserted into the distal phalanx, are

Anconad,
Ulnad,
by the extensor major;

Ulnad,
Thenad,
by the flexor longus.

Motions of the Distal Phalanx.

The motions of the distal phalanx, not necessarily extended to the proximal phalanx, or to the metacarp, are entirely confined to extension and flexion.

From the view here given of the motions of the metacarp, it may readily be seen how the whole thumb may, as well as the humerus, be made to turn round by successive inflections, beginning, suppose, at the radial aspect, and then passing successively from aspect to aspect till it come to the radial aspect again.

SECT. X.

MOTIONS OF THE BONES CONSTITUTING THE THREE PHALANXES OF THE FINGERS.

These motions are performed by the
Extensor communis digitorum *,
Indicator *,

* See p. 198.

Extensor proprius auricularis, seu minimi digiti †,
Abductor minimi digiti †,
Flexor parvus minimi digiti †,
Abductor indicis †,
Sublimis *,
Profundus †,
Lumbricales *,
Interossei *.

Motions of the Bones of the Proximal Phalanx.

These motions are,

Anconad,
Thenad,
Radiad,
Ulnad;

or motions in the intermediate directions. The motion anconad is generally called *extension*; the motion thenad is what is called *flexion*; while the two motions radiad and ulnad are those by which the fingers recede and approach one another.

Motion Anconad.

This is performed by the tendons of the *extensor communis*, assisted in the index by the *indicator*, and in the little finger by the *extensor proprius auricularis, seu minimi digiti*. When the whole of the communis is made to act at the same time,

† P. 199. * See p. 198.

the several fingers are seen to diverge like radii from a centre, the index pointing distad and radiad, the ring and little finger distad and ulnad.

From the lateral connections, however, observed between the tendons of the communis, it is incapable of extending completely a separate finger; the separate extension of the index and little finger being produced by the *indicator* and *extensor proprius auricularis** ; the *indicator* moving its finger a little ulnad, and in this function moderating the tendon of the communis.

Motion Thenad.

This is performed by the

Lumbricales,
Interossei,
Sublimis,
Profundus,

assisted in the index by its *abductor*, and in the little finger by its *flexor brevis*, and by its *abductor*.

From the *lumbricales* being inserted along with the tendons of the radial *interossei*, they are also disposed to move the fingers radiad.

The *interossei*, from running on the radial and ulnar sides, and very little thenad of the centre of

* Sometimes wanting.

motion, enjoy but a very limited power as to the flexion; while, from their connection with the tendons of the extensor communis, they seem to co-operate in extending the medial and distal phalanxes. In the same way the lumbricales, which during extension appear to assist the *radial interossei*, may during flexion assist the tendons of the profundus, and these tendons again assist the lumbricales, just as we see the carneous fibres by their lateral attachments shorten the tendons of penniform muscles.

The *sublimis* and *profundus*, in performing their flexions, make the fingers to approach both from the radial and the ulnar aspects towards the middle, moderating here the *extensor communis* with some of the interossei and lumbricales; and hence during flexion the fingers can never be separated so widely as during extension.

Motions Radiad and Ulnad.

These are performed by the *interossei*, which are named *external* or *internal*, according as they arise from the anconal or thenal aspect of the metacarpus; and, *prior* or *posterior* also by Albinus, according as they are inserted into the radial or ulnar aspects of the fingers. In these motions the radial interosseus of the index is assisted by the abductor indicis, and the place of ulnar interosseus in the little finger supplied by the *abductor minimi digiti*.

From muscles thus acting on the four aspects of each of the bones of the proximal phalanx, it must be evident that each of these bones may be turned round by successive inflections, so as to describe the circumference of a cone, though not turned round as in rotatory motions, which require that the muscles entering the bone should form with its axis less acute angles than are formed by the muscles of this digital phalanx.

Medial Phalanx.

The motions of the bones of the medial phalanx on those of the proximal are

Extension, and
Flexion.

The extension performed by the same muscles that extended the bones of the proximal phalanx; assisted, however, in extending the medial and the distal phalanxes by the *interossei* and the *lumbricales*, and in the little finger by its *flexor* and *abductor*.

Distal Phalanx.

The motions of the bones of the distal phalanx, on those of the medial, consist likewise of extension and flexion; the extension performed by the same muscles as in the medial phalanx, and the flexion, by the tendons of the *profundus*.

Although in these motions of the digital phalanxes the young anatomist may not be surprised at the extension of all the three by the same muscle, yet he certainly has some reason to wonder how it can maintain the extension of some, and, permit at the same time the flexion of others; and, more particularly, how proximal joints, rendered convex anconad * by means of flexion, should not stretch its tendons, and compel it to act with a greater force in extending those that are situated distad. To explain these phenomena, it may be remarked, that every phalanx has its own flexors; and that although the power of extension, however different the levers of resistance, be equal or nearly equal in all, the power of flexion may be different in each. As for the effects of convexity in the joints, it must be remembered that the stretching and relaxing of the tendons, as in many other cases, depend not entirely on the carneous fibres, but on changes of position; that the tendons of the *extensor* may be stretched and relaxed at the proximal joint by the convergence and divergence of the fingers: and if that be not permitted at the medial joint, yet there we have another mechanical contrivance, equally and admirably suited to the purpose; there each of the tendons may be observed dividing into two, the halves passing la-

* See page 295.

terally, to avoid the convexity, but uniting again; and leaving a rhomboidal space in the middle. By this simple mechanism the flexion of the medial joint does not prevent the flexion of the distal, although it is true that the power of extension would afterwards be less, from the laxity occasioned by the lateral separation, were not the *lumbricales* and the *interossei* at all times ready, and at all times prompted to give their assistance.

Summary Remark.

Although we cannot pretend to have seen, nor indeed to have explained, if we had seen, all the singular effects of mechanism in this singular organ, the atlantal extremity; yet, from what we have seen, with regard to its motions, that can be explained; with regard to the promptness, precision, and ease, and the almost incalculable variety of modes in which they may be combined and separated; performed with different degrees of force, velocity, extent, and in every conceivable order of succession; from reflecting on the aggregate number of motions in both the extremities, which naturally co-operate; recollecting that the thumbs and each of the fingers is separately endowed with the sense of touch, and that these, exclusively of their own motions, which are capable of combining in thousands of ways, may likewise participate in the motions of the trunk and sacral extre-

mities, in the motions of the clavicles, scapulæ, humeri, carpi, and metacarpi—we certainly must acknowledge the atlantal extremities to be admirably suited to the human intellect; that the power to plan, and the power to execute, have here been bestowed with a view to each other; and that it is certainly as much to the one as it is to the other, that man is indebted for most of the comforts and conveniences of life; for sciences, arts, commerce, manufactures; and, in short, for that distinguished pre-eminence over every other species of animated being that visibly inhabits this terrestrial globe.

CHAP. VI.

MOTIONS OF THE SACRAL EXTREMITIES.

The sacral extremities seem to have engaged more of the attention of physiologists than the atlantal. The attitudes of standing, with the motions of walking, running, and leaping, being thought subjects fit to receive illustration from the application of mechanical principles, many authors have

gratuitously offered their services in anatomy, and, satisfied with partial or limited views, have undertaken to explain mechanically the manner in which these phenomena are produced. To facilitate the application of their reasoning, they have generally proceeded on the supposition, that the animal machine is more restricted in its operations than it actually is; have dwelt much upon the effects arising from form, position, and magnitude; from the force of gravity, elasticity, and impulse; and but little upon those arising from the agency of the vital principle, without which the animal machine would have presented but few phenomena interesting or curious. It is thus we can account for the differences observed between their conclusions; succeeding authors accusing those who preceded them of errors, and boasting, not only of the truth and accuracy, but also of the novelty of their own observations. Had they commenced their several inquiries with more deliberate and extensive views, the anatomist must be convinced that they would have differed less as to the explanation of the manner in which standing, walking, running, and leaping are performed by animals, than they seem to have done. Every one knows, or easily may know, that the manner admits of a very considerable range of variety; that the equipoise, whether standing or moving, is not merely committed to the sacral extremities, but is shared by all the parts of the system: and that their different attitudes and

motions, the particular positions of the centre of gravity, the form of the body, and the will itself, have all certain mutual relations, that may be, and that are regularly varied in a thousand ways by occasion and circumstance. It is hence that some attitudes and motions peculiarly combined distinguish the *vagi*, or the in-kneed; some the *vari*, or the bandy-legged; that some are made to indicate species of exercise and sport; some the particular qualities of the ground or its substitutes at the time, as these are smooth, slippery, unequal, broad, narrow, moveable, or fixed; some, again, the different states of health and disease; and some the different emotions and passions. Now, in all these varieties of attitude and motion, as the position of the centre of gravity must necessarily correspond, it is surely inconsiderate to talk of any attitude or motion by which that position is to be always and uniformly regulated. In tracing the prints of an animal's feet on the snow or the sand, we find that those of the dog, the hare, and the horse when he walks, are in zigzag lines; and that those of the cat, of the fox, and the horse when he is galloping at full speed, are usually in straight, or in nearly straight lines. And thus, I am told, can sportsmen frequently, from these impressions, and very often independent of their form, not only guess the species of animal, but also the velocity with which it was moving at the time the several marks were imprinted.

Without appealing, then, to effects that have been ascribed to the influence of demons; effects that are known occasionally to occur in hysteria, madness, and in the penances of eastern devotees, where motions, accompanied with vigorous exertions, are continued for periods that to almost any but ocular witnesses would appear incredible, and where attitudes, naturally fatiguing and painful, are persevered in for numbers of years without interruption—the motions and attitudes, and the ways of equipoising the body, not only on the feet, but the head and the hands, and in a variety of singular circumstances, as practised by vaulters, dancers on ropes, and by those who exhibit singular feats of agility in horsemanship, are of themselves proofs incontestable, that the combinations of attitude, and motion, and equilibration, in the human body, are next to incalculable, and that new combinations might still be produced by further attempts, by practice, and study. Such phenomena should instruct us to be cautious as to the grounds on which we presume to limit the powers of the animal structure when under the influence of its vital principle; and even with respect to inferior animals, should warn us not to conclude too hastily from general appearances, that this or that animal cannot exhibit this or the other attitude and motion. Before we venture to make such assertions, we should first inquire, whether the animal was ever inclined, ever compelled, ever instructed, or

was ever capable of being instructed, to make the attempt? or, if the attempt had been made, and had failed, still we should inquire, how far habit might have restricted the actions of its muscles? how far fear, naturally accompanied by peculiar attitudes, might have interfered? how far the attention had been excited? and, more particularly, how far the object of the experiment had been rightly conceived?—seeing every variety of attitude and motion must partly depend on that power by which the muscular functions are directed, and that that power, whether intelligent from instinct or otherwise, must always, in order to prepare the muscles, whether for motion, attitude, or equipoise, have some previous knowledge of the circumstances to which it is accommodating the actions of its organs. From the want of such knowledge, the blind, the dizzy, and the intoxicated, are constantly in danger of losing their balance; and the two last, in many an instance, not capable either of standing or walking upon level ground.

Had physiologists previously taken these general views, many disputes about the manner in which some of the ordinary motions are performed had never occurred. The dispute, for instance, whether in walking the pressure be removed from the heads of the femora by the alternate inclinations of the trunk, or by a sort of projectile impulse from the femora below, is one of those that have originated

in partial views. To remove the pressure by the alternate inclinations of the trunk, is undoubtedly the mode that is in general the least fatiguing, the most usually adopted, and perhaps the most graceful; but, taken alone, it is not sufficient in ascending a stair, in hopping or running; nor is it adopted by some, who are awkward and hobbling in their gait, even when walking in ordinary cases upon level ground. Another dispute, and which has arisen from similar views, is, whether the feet, when brought alternately forward in walking, be made to move in parallel lines, or in lines that are curved dextrad and sinistrad? and if in the curved, whether the curves, in this way) (, be convex *tibiad*, or, in this way ( ), convex *fibulad*? The truth is, they may, if we choose, be made to move in lines that are parallel, although, to preserve the lateral range of the centre of gravity between the points from which they set out and in which they terminate, and also to diminish, while in their progress the alternate and lateral inclinations of the trunk, they generally are moved in lines that are convex *tibiad:* the lines that have their convexity *fibulad* being usually reserved for those cases where the space is limited towards right and left, and where the feet are obliged to cross, in order to terminate in the same straight line; or for those cases where the joints are rigid, or when the muscles, as

in hemiplegia, can with difficulty perform their flexions and extensions.

These marks,) (( ), being intended chiefly to illustrate what was meant by *convex tibiad* and *convex fibulad*, they are not to be considered as descriptive of the lines which the feet observe in the motions of walking. To form some idea of these lines, it must be recollected, that on quitting the ground the feet are moved forwards and upwards, then forwards and downwards; and that their motions in these directions may be, and are very often, combined with those of rotation, adduction, and abduction. To think of exhibiting such lines upon paper, or to think of ascertaining their indefinite course from merely the impressions that are made upon the ground, would be but an idle and puerile conceit. If the impressions from the feet of a person who has been walking regularly forwards be carefully examined, it will generally be seen that they are bounded by parallel lines, supposed drawn so as to touch the outmost extremities of the lateral points; that the impressions of each foot are bounded respectively by similar lines; and that all the impressions of the same foot, from the heel to the toes, are themselves parallel. Such impressions, are certainly not calculated to furnish criteria by which we may judge of the varied and indefinite motions of the foot when it is raised, and when it is employed with the head and the neck, the trunk and the hands, to form a sort of transient

equipoise on the proximal head of the opposite femur.

When a man is standing, and with equal pressure upon both legs, the centre of gravity will be in the middle; if the pressure be unequal, it will be found towards that side where the pressure is greatest; if he stand entirely upon one leg, it will fall within the base of the foot on which he is supported; if he walk or run, it will constantly be shifting between right and left, and always inclining from that part where the one foot touches the ground to that part where the other foot is to touch in its turn. If he be afraid of falling to a side, the range of this centre will be increased dextrad and sinistrad; and sternad and dorsad, if afraid of falling either backwards or forwards: if he run without fear, the lateral range will be somewhat diminished; or if he be more than usually anxious to preserve his balance, both the ranges will be augmented. The efforts in leaping will be best explained by that figure which already has been given*; although in the figure the centre of gravity, contrary to that which actually happens, be supposed to fall towards the heel: this supposition, with the other respecting the rigidity of the spine, having been adopted, as they did not materially affect the illustration, in order to render the figure less complex.

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* See p. 291.

From these accounts of our attitudes and motions, of which in general so great a share has been ascribed to the sacral extremities, we shall now proceed to give some account of the muscular functions of these extremities; and observe here, on purpose to save unnecessary repetition, that in walking and running, most of their muscles are peculiarly circumstanced, in having their places of opposite attachment alternately the moveable and fixed points: In both of which cases the directions of their actions may be inferred from the functions ascribed to them.

The motions peculiar to the sacral extremity consist of the different motions of the *femur*, *tibia*, *tarsus*, the *metatarsus*, and *digital phalanxes*.

SECT. I.

MOTIONS OF THE FEMUR.

THE motions of the femur are those of

Extension,
Flexion,
Abduction,
Adduction,
Rotation.

Of these motions,

Extension, carrying the femur dorsad;
Flexion, sternad;

Abduction, laterad;
Adduction, mesiad; and
Rotation turning it round on its axis in two directions; and, therefore, either rotation fibulad or rotation tibiad, as it turns the toes outwards or inwards.

The muscles employed to perform these motions, are the

Tensor vaginæ femoris*,
Gluteus magnus*,
medius*,
minor*,
Pyriformis*,
Gemini*,
Obturator internus*,
Quadratus femoris*,
Sartorius†,
Gracilis†,
Semitendinosus†,
Semimembranosus†,
Biceps cruris†,
Rectus cruris†,
Adductor brevis femoris*,
longus femoris*,
magnus femoris*,
Psoas magnus*,
Iliacus internus*,
Obturator externus*.

Of which number, the six following, the *sartorius*, the *gracilis*, the *semitendinosus*, the *semimembranosus*,

* See p. 202, 203. † See p. 204.

the *rectus cruris*, and the long head of the *biceps cruris*, are inserted, not into the femur, but into the leg; the last being inserted into the fibula, and the other five into the tibia: The *rectus cruris*, through the medium of the rotula: through which medium, the *tensor vaginæ* is likewise inserted into the tibia after its attachment in the *linea aspera*.

The extensors are the

Gluteus magnus,
medius (a part of),
minor (doubtful if part of),
Pyriformis,
Obturator internus,
Gemini,
Quadratus femoris,
Adductor magnus (from the tuberosity of the ischium),
Biceps cruris (long head of),]
Semitendinosus,
Semimembranosus,

The flexors are the

Sartorius,
Gracilis,
Tensor vaginæ,
Pectineus,
Adductor longus,
brevis,
magnus (from the crus of the ischium),
Iliacus internus,
Psoas magnus,
Obturator externus,
Gluteus minor.

The abductors are the

Tensor vaginæ,
Gluteus magnus,
medius,
minor,
Pyriformis,
Sartorius,
Obturator internus,
Gemini.

The adductors are the

Pectineus,
Adductor brevis,
longus,
magnus,
Quadratus femoris,
Gracilis,
Semitendinosus,
Semimembranosus,
Biceps cruris (long head of),
Obturator externus,
Psoas magnus,
Iliacus internus.

The rotators fibulad are the

Gluteus magnus,
medius (part of),
minor (doubtful if part of),
Pyriformis,
Gemini,
Obturator internus,
Obturator externus,
Quadratus femoris,
Iliacus internus,
Psoas magnus,

Adductor magnus
longus,
brevis, and the
Biceps cruris, a little, if the leg be extended.

The rotators tibiad are the
Tensor vaginæ,
Gluteus medius (part of),
Gluteus minor,
with the
Sartorius,
Gracilis,
Semitendinosus,
if the leg be extended.

All these muscles, when the femur is fixed, are calculated to produce similar motions likewise on the trunk: the abductor forces inflecting it *fibulad*; the adductor, *tibiad*; the rotatory *fibulad*, turning it round by the dorsal aspect; and the rotatory *tibiad*, round by the sternal. Or, if the trunk happen to be moved on the two femora at the same time, the flexor and extensor forces of both will co-operate with those of their own class; the abductor forces with the adductor, and the rotatory *fibulad* with the rotatory *tibiad* of the opposite femur.

From observing here, that some muscles and parts of muscles are flexors and abductors, some abductors and extensors, some extensors and adductors, and some, again, adductors and flexors, it is easy to conceive how the femur, by these, may

be made to describe the circumference of a cone*. From a muscle, however, or the part of a muscle, being thus employed in different functions, from the great facility with which these different functions are combined, and the small extent to which some of them are carried even in the most favourable positions of the femur, cautions, similar to those recommended in examining the functions of the several muscles belonging to the humerus, become equally necessary here. All these muscles should be examined before the anatomist has destroyed with his knife their relative connections; and then the motions of extension, flexion, abduction, adduction, and rotation, should be performed separately and slowly, and with every possible care and attention, to prevent their combinations, which, if they should happen without being noticed, would lead to very erroneous conclusions.

From the joint at the hip admitting of motions similar to those produced at the shoulder, and from recollecting that the femur and pelvis cannot so readily accommodate themselves to one another's motions as the scapula and humerus, one might at first be inclined to imagine, from these circumstances, from the varied functions of those numerous muscles, and the greater forces which they have to exert, that the joint at the hip would be of the two the

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* See p. 387.

most frequently luxated. To prevent, however, such an occurrence, the head of the femur is sunk to the neck in the acetabulum; while the actions here required of the muscles are usually less irregular and extensive than those at the shoulder, and consequently less exposed to irregular action. At the same time, in cases of abduction, the head of the femur is pushed to the bottom of the acetabulum; while in adduction, where it points peripherad, and towards the margin, it must always receive, though the muscles be unguarded, a proper, though not irresistable, direction from the round ligament—a ligament that is useful, not only by exciting the synovial gland to proportion its secretion to the quantity of motion, but which, by another mechanical contrivance, can afford a security to the motions of the joint that we could not have expected from its physical strength.

The eye, in tracing the line of the femur from the distal towards the proximal extremity, will perceive, near the *trochanter major*, a sudden and obvious change of direction. This change of direction removes the femora to a greater distance, enlarges at the pelvis the lateral range of the centre of gravity, alters the course, and diminishes the force of percussion from below, lengthens the lever of the different muscles, allows a sufficient space for their bulk, the genital organs, and the alvine discharges, and, lastly, making the change of appearance from the trunk to the femora to be less a-

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brupt, at once contributes to promote the vigour and steadiness of motion, the safety and the general symmetry of the system.

As to the mode of reducing the femur after luxation, it will be sufficient to recommend an attention to those circumstances that were formerly mentioned in treating of the humerus. In attempting this reduction, the functions and force of the rotatory muscles should never be neglected, but strenuously either opposed or assisted by bending the leg, and rolling the femur *tibiad* or *fibulad* as the case may require.

SECT. II.

MOTIONS OF THE TIBIA.

These are limited to extension and flexion; and the muscles which perform them are the

Rectus cruris *,
Vastus internus *,
Vastus externus *,
Cruralis *,
Tensor vaginæ *,
Gluteus magnus †,

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* P. 204. † See p. 202.

Gracilis *,
Sartorius *,
Semitendinosus*,
Semimembranosus *,
Biceps cruris †,
Gemellus ‡,
Plantaris ‡,
Popliteus *.

The extensors are the

Rectus cruris,
Vastus internus,
Vastus externus,
Cruralis,
Tensor vaginæ,
Gluteus magnus.

The flexors are the

Gracilis,
Sartorius,
Semitendinosus,
Semimembranosus,
Biceps cruris,
Gemellus,
Plantaris,
Popliteus,
Tensor vaginæ,
Gluteus magnus.

Should it be asked, why the *tensor vaginæ* and *gluteus magnus* are here introduced as muscles of the tibia, and why they are supposed to act not only as extensors but flexors, the reply is, that

* See p. 204. † P. 205. ‡ P. 206.

both muscles are evidently tensors of the vagina; and that the vagina, occupying the fibular aspect of the femur, and being continued distad as far as the tibia, is in passing the joint extended *rotulad* and *popliteud* of the centre of motion; whence the two parts on different sides of the centre of motion are alternately relaxed and alternately stretched during the extension and flexion of the tibia.

The *rectus cruris*, as a flexor of the femur, is somewhat relaxed when the femur is inflected; and, therefore, often in ascending a hill, or rising with a heavy weight on the shoulders, we are led instinctively, by a sense of weakness, to press with our hand against the rotular aspect of the femur, and to assist its exertions; to promote which, and to preserve the *rectus* in its place, the two *vasti* are inserted laterally into its tendon, while the *vastus internus* is itself assisted in this operation by the tendon of the *adductor magnus*, from which several of its fibres originate.

The two *vasti*, proceeding from their origins *rotulad* and *distad*, and concealing the *cruralis*, not only perform the office of a fascia to that muscle, but contribute likewise to support the femur, just as a cord, when closely and spirally twisted on a rod, will add to its strength. Both these muscles, besides their insertion into the *rectus*, where they form the appearance of a penniform muscle, are inserted laterally into the rotula, and then into the tibia. From this last insertion, they are able, when

the rotula is fractured transversely, to extend the tibia, though with no great force, partly from a deficiency of lever, partly from wanting the assistance of the *rectus* and the *cruralis*, and partly, too, from wanting the assistance of their own fibres, that are laterally attached to the tendon of the *rectus*.

To the two *vasti*, the *cruralis* and *rectus*, the rotula performs the office of a pulley; it also removes them to a greater distance from the centre of motion, and adds to their levers. In resting on the knee, it is better calculated than mere tendon to bear pressure and resist injury, and in its motions requires less of the lubricating fluid. For, had a tendon been substituted, we should naturally suppose, judging from analogy, that it would have been surrounded with synovial membrane, like what we see surrounding the tendons at the carpal ligaments. Now, this membrane, with the apparatus contained within the capsule, might certainly have added to that frequency of disease to which this joint, from its actual apparatus, and its greater extent of articular surface, is already more exposed than any other joint in the whole system.

The *gracilis*, the *sartorius*, and the *semitendinosus*, after reaching the tibia, proceed in their course distad and rotulad; and, in conformity with the *biceps brachii* and the *biceps cruris*, transmit each an aponeurosis to support the fasciæ, enveloping the muscles of the next articulation. From the

nature of their course, they are capable of performing a slight degree of rotatory motion upon the tibia when it is inflected; and in this rotation are partly assisted by the *semimembranosus* and the *popliteus;* while, on the contrary, they are moderated by the *biceps*. It is only, however, in particular circumstances, as when the functions of flexion and extension are both suspended, that they ever are permitted to roll the tibia. For, when they and the *biceps* are made to act at the same time in bending the leg, or moderating the extensors, that very direction which gave them the power of rotatory motion, is now made the means by which rotation is only the more effectually resisted*; and hence it would appear, that this direction was rather intended to prevent rotation when the muscles are employed in vigorous exertions, than to promote it when they have no other business to perform. As a farther confirmation of this opinion, the *vastus internus* and *vastus externus*, which are made to act at the same time, and are prevented from acting alternately by their attachments, must likewise oppose rotatory motion; in which opposition they will be assisted by the lateral ligaments, the heads of the *gemellus*, and in the rotation of the femur *fibulad*, or the tibia *tibiad*, by the crucial ligaments†.

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* See page 339.

† See page 306.

As for their rotatory power on the femur, the case is different; they are there permitted to act alternately in flexion, extension, adduction, or abduction.

As the *gracilis* and *sartorius*, like the *rectus cruris*, are somewhat relaxed when the femur is inflected, so the long head of the *biceps cruris*, with the *semitendinosus* and the *semimembranosus*, are somewhat stretched, and in these circumstances enabled to bend the joint of the knee to a greater extent*; the convexity of the joint operating here in a manner that is well explained by Borelli in those propositions †, where he proves that the flexion at the joint of the heel must in certain birds, whether dead or alive, be accompanied by the flexion of their digital phalanxes. It is true, indeed, that in these propositions the late Vicq d'Azyr, after showing more than usual anxiety to point out some myographical errors, and after asserting just what Borelli had asserted before, that one flexor only passes over the convexity at the knee, has, by artfully concealing what Borelli has said of the joint of the heel, and by insinuating what he has not said of the joint of the knee, completely succeeded in convincing Barthez that his cavilling criticism is an able refutation ‡. But the leg of a

* See page 296.

† De Motu Animalium, Prop. CXLIX. et CL.

‡ " Un phenomène remarquable de la station des oiseaux,

bird *that perches in its sleep* is easily procured, and children, who in general are fond of the experiment, can demonstrate the fact which Borelli has explained, and which he has explained by descriptions of the muscles, sufficiently minute, and sufficiently accurate, to support his conclusions.

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c'est qu'ils peuvent se soutenir fermement, et même dormir, appuyés sur des branches d'arbre qu'ils embrassent avec les doigts; de sorte qu'ils ne peuvent en être renversés alors par des coups de vent, et qu'ils y restent même quelquefois accrochés aprés la mort. Borelli a voulu donner une explication méchanique de ce fait singulier. Cette explication a été répétée par Monro: mais elle a été bien refutée par M. Vicq d'Azyr. Cependant personne n'a donné d'autre explication de ce fait, qu'on a rapporté vaguement à l'irritabilité des muscles. BARTHEZ, *Nouvelle Mechanique des Mouvements de l'Homme et des Animaux.*

"Il suit de ces descriptions, qu'il y a trois puissances destinées à la flexion des doigts des oiseaux, mais une seule s'étend au-dessus des condyles du tibia, et il est important d'observer que les tendons de ce muscle ne passent point au-delà de la première phalange: *c'est donc à tort que Borelli assure que tous les fléchisseurs s'insèrent au femur.* Il n'a sans doute avancé cette proposition, que pour donner plus de vraisemblance à l'explication qu'il donne de la force et de la facilité avec laquelle les oiseaux serrent les branches des arbres pendant qu'ils dorment; il prétend qu'elle est absolument méchanique, et qu'elle n'est due qu'a ce que leurs tendons sont relativement moins longs que leurs extrémités, lorsque les pièces qui les composent sont flechies l'un sur l'autre, comme il arrive dans le sommeil de l'oiseau. Cette longueur relative des tendons est diminuée, selon lui, par le grand nombre d'angles que font alors les différentes pièces entr'elles, mais les muscles qui flechissent les moyennes

The joint of the knee, like the joint of the elbow, and like every other joint that is interposed between the first and the last joints of either the atlantal or sacral extremities, is affected by muscles that act principally on the neighbouring joints which are proximad and distad; and hence it is, that in enumerating the several flexors and extensors of the tibia, we find flexors and extensors of the femur, as well as two extensors of the tarsus, namely, the *gemellus* and the *plantaris*.

From the *gemellus* being not only a flexor of the tibia, but extensor of the tarsus, it must be evident that the one should be inflected and the other extended, whenever the tendo Achillis is ruptured. To effect those purposes, a cord should be fixed to the heel of the shoe, and a ring, somewhat like a dog's collar, but in two parts, be made for the thigh at a small distance proximad of the rotula. Between a hook fixed in the ring and the heel of the shoe

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et les dernières phalanges ne s'étendent pas, *comme il l'a cru, jusqu'au fémur*; et d'ailleurs cet effort peut-il avoir lieu sans que la chair du muscle soit tiraillée ? Si elle l'est, n'entre-t-elle pas nécessairement en contraction ? Son irritabilité lui permet-elle de rester en repos, et ne suffit-elle pas pour expliquer ce phénomène ? Ajoutez à cela que les oiseaux carnaciers peuvent étendre leurs doigts lorsque la jambe et l'os du métatarse sont fléchis, comme on peut s'en convaincre, en considérant avec attention les différentes attitudes qu'ils prennent lorsqu'ils saisissent et qu'ils retournent leur proie en différens sens." VICQ D'AZYR, *Anatomie des Oiseaux*.

the cord should be drawn so as at once to extend the one and inflect the other; while, to prevent the lateral motions of the foot at the ancle, a mould should be formed of that pasteboard which is used in the binding of large folios. It is readily softened in warm water, and applied in that state to the rotular and lateral aspects of the joint, and extending a little proximad and distad, it will soon harden and preserve the parts in exactly the position in which they gave it shape. The ring here mentioned is entirely the suggestion of an ingenious and intelligent artist, who had the tendo Achillis ruptured, and who complained when the cord was tightened around his thigh, that it occasioned a deal of uneasiness, and when it was slackened to admit of compresses being interposed, that it was always ready to slip. On trying the ring of his own contrivance, which he previously lined with a soft substance, he found it equally secure as the cord when it was tightened; and in consequence of its pressing merely on a point which he could alter by the rolling of the femur, it scarcely produced any uneasiness. By such an apparatus, which he procured at a trifling expence, and the use of crutches, which enabled him to continue the greatest part of his former habits, which were those of great sobriety and industry, he recovered completely in the course of less than seven weeks.

The luxation of the knee-joint occurs but seldom, from the little variety of the muscular func-

tions, and from the muscles, whether they are moderators or motors, being always employed to act as directors; in which office they are regularly supported by the lateral ligaments.

SECT. III.

MOTIONS OF THE FIBULA.

The fibula admits of little change in relative position with respect to the tibia, except what arises from the elasticity of its several ligaments in resisting the concentration of forces, and preventing the injuries attendant on concussion. It has no immediate connection with the knee-joint, and in many animals as little connection with the joint of the tarsus; in some being only a small bone extending a short way distad on the leg, and in others merely a process of the tibia, resembling the ulna, whose length and magnitude appear, in the different species of animals, to be regulated by the quantity and variety of motion that usually takes place beyond the distal extremity of the radius. Its length and magnitude are often proportioned to the number and bulk of the carneous fasciculi that originate in the leg; and the quantity of these generally proportioned to the variety and extent of motion beyond the distal

extremity of the tibia. In the human leg, its connection with the tibia is secured both by ligaments and muscles; at the two extremities, by accessory ligaments *peripherad* of the capsules; thro' the space interposed between the extremities, by that ligament named *interosseous*, by muscles attached to it and the tibia, and by muscles that cross the interosseous space. The muscles attached to it and the tibia, are the

Soleus,
Tibialis posticus,
Extensor longus digitorum,
Flexor longus digitorum;

and the muscles that cross the interosseous space, the

Tibialis anticus,
Extensor proprius pollicis,
Flexor longus pollicis.

It is these muscles, and more particularly the last three, that explain the phenomenon which frequently occurs when the fibula is fractured: I mean, the inclination of one or both of the broken ends towards the tibia.

SECT. IV.

MOTIONS OF THE TARSUS.

These are

Rotulad,
Poplitead,

Fibulad,
Tibiad,

or in some of the intermediate directions; the motion *rotulad* being what is called *flexion*; the motion *poplitead*, what is called *extension*; and the two motions *fibulad* and *tibiad*, slight inflections *outwards* and *inwards*, that perhaps might be named *abduction* and *adduction*. They are so related, that the flexion and extension may be performed in any state of abduction or adduction, or adduction and abduction, in any state of flexion or extension.

The muscles concerned, are the

Tibialis anticus *,
Extensor longus digitorum *,
Extensor proprius pollicis †,
Peroneus tertius †,
Gemellus ‡,
Soleus ‡,
Plantaris ‡,
Flexor longus digitorum *,
Flexor longus pollicis †,
Tibialis posticus *,
Peroneus longus †,
Peroneus brevis †.

In the motion rotulad, the

Tibialis anticus,
Extensor longus digitorum,
Extensor proprius pollicis,
Peroneus tertius :

* Vide p. 204. † P. 205. ‡ P. 206.

In the motion poplitead, the
Gemellus,
Soleus,
Plantaris,
Flexor longus digitorum,
Flexor longus pollicis,
Tibialis posticus,
Peroneus longus,
Peroneus brevis:

In the motion fibulad, the
Peroneus longus,
Peroneus brevis,
Peroneus tertius,
Extensor longus digitorum:

In the motion tibiad, the
Tibialis posticus,
Extensor proprius,
Flexor longus digitorum,
Flexor longus pollicis.

If besides these, there appear at times to be obvious rotatory motions of the foot, it is to be observed, that such motions, though generally combined with the two motions fibulad and tibiad, do not properly belong to the joint of the tarsus; they may always and easily be traced to the femur, the tibia, or to both: if the knee be extended, the rotatory motions are to be ascribed entirely to the femur; if it be inflected, partly to the tibia; in which case the rotation of the femur will often be combined with slight degrees of adduction and abduction.

If the toes, therefore, be seen to point either

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forwards and outwards, or forwards and inwards, we must, in the well-formed sacral extremity, if the knee be extended, look for the causes principally in the femur; its rotators *fibulad*, consisting of extensors, flexors, abductors, and adductors, are more numerous and more powerful than its rotators *tibiad*; and whenever, either in standing or walking, a free easy lateral swing is allowed to the trunk, the rotators *fibulad*, or the abductors, must be brought into action, the toes turned out, or the space between the two feet widened, to enlarge proportionally the lateral range of the centre of gravity. If that range, however, be restricted, by checking the lateral inclinations of the trunk, by fear, awkwardness, or any other circumstance, the toes then may be turned inwards; and if the cause be allowed to operate with frequency sufficient to induce habit, a share of the positions, which the parts had *in utero* for the sake of occupying the least possible space, may in some measure be continued through life.

As the *gemellus* and the *soleus* are not the only extensors of the tarsus, why, it may be asked, cannot the tarsus then be extended, though with less force, after the tendo Achillis is ruptured, and particularly if ruptured without any pain? To answer the question: the *gemellus* and *soleus*, strong as they are, would not be sufficient, by a moderate exertion, to raise the weight of the body on the tarsus without such a lever as the os calcis.

The other muscles, excepting the slender and feeble *plantaris*, have not such a lever. Besides, being destined to perform other functions, and to act here only as auxiliaries, they are not prepared for the change of circumstance, and they want that connection with the joint of the knee which is necessary for mutual accommodation in any exertion where the two joints are required to co-operate.

SECT. V.

MOTIONS OF THE SEPARATE BONES OF THE TARSUS.

THESE bones, like those of the carpus, admit of little change in relative position, except such a change as enables them to diffuse the concentrated forces of pressure and concussion; and hence the muscles that more immediately act upon one of them have their influence indirectly extended to the whole.

SECT. VI.

MOTIONS OF THE SEPARATE BONES OF THE METATARSUS.

THE observations on the bones of the tarsus may, with equal justice, be applied to those composing

the metatarsus; as no bone here, like the metacarpal bone of the thumb or the little finger, is found to admit of a separate motion to any extent that is easily perceptible.

SECT. VII.

MOTIONS OF THE BONES OF THE TARSUS AND METATARSUS.

These bones, by their forms and arrangements, are made to constitute a general surface that is concave *poplitead* or *plantad*, and another surface that is convex *rotulad*. In short, they seem to constitute arches from the proximal to the distal, and from the tibial to the fibular aspects: one arch beginning at the rotular aspect of the os calcis, and thence extending along the astragalus, the os naviculare, the three cuneiform bones, and the three first of the metatarsals; another commencing at the distal extremity of the os calcis, and thence extending along the cuboides, and the fourth and the fifth of the metatarsals; and a third extending from right to left, formed at one part by the five metatarsals, and at another by the os cuboides and the three cuneiform bones: The parts constituting these three arches being retained in their relative positions, partly by ligaments surrounding the capsules

of articulation, and running in a number of different directions; partly by the plantar aponeurosis; partly by strong muscular tendons mutually interwoven, intermixed with the ligaments, and stretching from one bone to another; and partly, too, by the action of muscles drawing from the distal to the proximal aspect, from one lateral aspect to another, or from the distal and lateral aspects to some points that are situated in, or near the os calcis. For the os calcis being the bone that affords the most general support to the arches, is also the bone from which, or its neighbourhood, most of the muscles connected with the arches proceed to their insertion. This bone furnishes an origin wholly, or in part, to the

Extensor brevis digitorum,
Flexor brevis digitorum,
Flexor accessorius, seu massa carnea Jacobi Sylvii,
Flexor brevis pollicis,
Adductor pollicis,
Abductor pollicis,
Abductor minimi digiti;

while the *flexor longus digitorum pedis* and the *flexor longus pollicis pedis*, by uniting and crossing where they happen to meet with the *flexor accessorius*, constitute a central point of their own, near to the place where the preceding muscles originate; and thence, with these and the four *lumbricales*, radiate also in different directions to the digital phalanxes: The *transversus pedis*, in the

meanwhile, giving its support by crossing directly from side to side; the *adductor pollicis* and *peroneus longus* by crossing obliquely; and the common extensors on the rotular aspect, like the common flexors on the popliteal, by radiating each from contiguous centres, by crossing in their course, and by drawing their insertions, like most of the other muscles of the foot, to points that are either situated in or near the os calcis.

The arches of the foot being thus constructed, and more or less, according to circumstances, vigorously supported by the action of muscles, are not only calculated to afford a safe and general protection to the muscles, the nerves, the sanguiferous vessels, and the absorbents on the plantar aspect; but by their elasticity, and the number of the parts of which they are composed, are admirably fitted to diffuse the effects of concentrated forces, whether they proceed from above or below; to accommodate themselves in some measure to the forms of the objects which are brought into contact; and to add to that springy or elastic motion which contributes so much to lessen fatigue in walking and running.

SECT. VI.

MOTIONS OF THE BONES OF THE DIGITAL PHALANXES.

OF THE DIGITAL PHALANXES OF THE FIRST, OR GREAT TOE.

THESE phalanxes, like those of the thumb, are limited to two, a proximal and a distal:

PROXIMAL PHALANX.

The motions of the proximal phalanx are,

Rotulad,
Poplitead,
Fibulad,
Tibiad,

or combinations of these motions;

And are performed by the

Extensor brevis digitorum *,
Extensor proprius pollicis *,
Flexor brevis pollicis *,
Flexor longus pollicis *,
Abductor pollicis *,
Adductor pollicis *,
Transversus pedis *:

The motion rotulad, by a tendon of the

Extensor brevis digitorum, and by the

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* P. 212, 213.

Extensor proprius pollicis:

The motion poplitead, by the
Flexor brevis pollicis,
Flexor longus pollicis,
Abductor pollicis,
Adductor pollicis,

The motion fibulad, by the
Adductor pollicis,
Transversus pedis:

The motion tibiad, by the
Abductor pollicis.

Distal Phalanx.

The motions of the distal phalanx are,
Extension, and
Flexion:

The first performed by the
Extensor proprius:

The second, by the
Flexor longus.

The metatarsal bone of this toe, unlike the metacarpal bone of the thumb, admits of nearly as little motion as the other bones with which it is classed.

Motions of the Bones constituting the Proximal, Medial, and Distal Phalanxes of the Small Toes.

Proximal Phalanx.

The motions of the bones of the proximal phalanx are,

Rotulad,
Poplitead,
Fibulad,
Tibiad,

or combinations of these motions;

And are performed by the

Extensor longus digitorum *,
Extensor brevis digitorum *,
Lumbricales *,
Flexor brevis, seu sublimis *,
Flexor longus, seu profundus *,
Interossei *,
Flexor brevis minimi digiti *,
Abductor minimi digiti * :

The motion rotulad, or what is called *extension*, by the

Extensor longus digitorum, and
Extensor brevis digitorum (the fifth toe excepted) :

The motion poplitead or plantad, commonly called flexion, by the

Lumbricales,
Interossei,
Flexor brevis, seu sublimis,
Flexor longus, seu profundus,

Assisted in the fifth toe by the

Flexor brevis minimi digiti, and
Abductor minimi digiti :

The motion fibulad, by the

Fibular interossei ;

In the fifth toe, by the

Abductor minimi digiti :

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* Vide p. 214, 215.

The motion tibiad, by the
Tibial interossei.

MEDIAL PHALANX.

THE motions of the bones of the medial phalanx are,
Extension, and
Flexion:
The first performed by the
Extensor longus, and
Extensor brevis (the fifth toe excepted),
Occasionally assisted by the
Lumbricales, and
Interossei *:
The second, by the
Flexor brevis, seu sublimis,
Flexor longus, seu profundus.

DISTAL PHALANX.

THE motions of the bones of the distal phalanx, like those of the medial, are also confined to
Extension, and
Flexion:
The first performed by the same muscles that performed the extension of the medial phalanx; the second by the *flexor longus digitorum*.

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* Vide p. 414.

General Remarks.

Though the sacral extremities do not derive so free and extensive motions from the trunk as the atlantal; though they do not participate in motions corresponding to those of the two clavicles and scapulæ; though their fibulæ be fixed with respect to the tibiæ; though their digital phalanxes be comparatively short, and all their metatarsals admit comparatively but of little motion: yet their strength is greater than that of the atlantal, their obedience to the will equally prompt; and as they communicate to the system at large a quantity of motion greater than what they receive in return, they contribute more to the general health, so far as that is dependent on exercise. In short, the two atlantal extremities perform a greater share of the functions that characterise the genus and species; the sacral extremities, a greater share of the common functions essential to life: while both kinds, if viewed with a reference to the several offices they are destined to perform, bespeak a degree of wisdom and foresight in the contrivance, which beings of our limited intelligence would more prudently admire and adore than attempt thoroughly to comprehend.

CHAP. VII.

MOTIONS OF THE AURICLE.

The lower animals are frequently observed moving their auricles, and in some measure varying their form, according to the intensity and direction of the different sounds to which they are listening. It is even said, that some wandering predatory tribes of the human species, who are naturally led to look with suspicion on every wood, thicket, ravine, and cavern, which they pass, and to mark with attention every sound that floats in the air by night or by day, are also accustomed to move their auricles in a similar manner. But be that as it may, the individuals of civilized nations, being seldom placed in such situations, seldom make use of the muscles of their auricles; and hence these muscles, originally slender, and growing daily more so by disuse, rarely produce any obvious effects, and, one or two excepted, rarely exhibit any thing more than the semblances of muscles. Their names are

Attollens auriculam,
Anterior auriculæ,
Retrahentes auriculæ,
Tragicus,
Antitragicus,
Major helicis,
Minor helicis,
Transversus auriculæ.

As to their functions, I can add nothing satisfactory or important to what has been observed by the truly estimable and accurate Albinus. In the first Book of his *Historia Musculorum*, although he speaks doubtfully of some of them as muscles *, in the third Book he is more decided, and assures us, not only that they are muscles, but that he had observed their effects in himself †. Not pretending to have had such experience, I subjoin his account of their functions in the note ‡.

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* "Aut veri musculi sunt, aut certe ipsis quam simillimi." Lib. i. cap. vi. See also p. 13. of this Work.

† "Sequentes auriculæ minusculi sunt et prætenues; veri tamen quorum etiam actiones in nobis observavimus." Lib. iii. cap. xxvi.

‡ "*Attollens auriculam* sursum trahit auriculam, tenditque illam ejus partem cui insertus; maxime si eodem tempore agant *frontales* et *occipitales*.

"*Anterior auriculæ* helicis eminentiam illam quæ concham distinguit, trahit in priora sursum, ac tendit.

"*Retrahentes auriculæ* concham tendunt, auriculam trahunt retrorsum.

"*Tragicus* eam cui incumbit conchæ partem deprimit, fa-

Motions of the Bones in the Tympanum.

The bones in the tympanum are the malleus, incus, the os orbiculare, and stapes; and the muscles destined to move these bones, and through these bones the membrana tympani, are the

Externus mallei,
Laxator tympani *,
Tensor tympani,
Stapedius:

The three first attached to the malleus, and the last to the stapes. By these muscles, the membra-

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citque planiorem; superiorem tragi marginem in priora extrorsum vertit.

" *Antitragicus* extremum antihelicem deprimit antitragum versus: hujus maxime eminentem marginem nonnihil extrorsum in posteriora vertit: marginem conchæ inter locum unde ipse oritur, atque eum cui insertus, medium premit, incurvat, ut in concham assurgat, magisque tendatur.

" *Major helicis* premit, deprimit, percutit partem eam helicis cui incumbit: illam vero cui insertus, modice deorsum trahit.

" *Minor helicis* incisuram helicis, cui affixus, contrahit; partemque quam occupat, premit, percutit.

" *Transversus auriculæ* contrahit, quod auriculæ inter concham et antihelicem cum scaphâ intercedit; idem, cum conchâ et scaphâ tendit." Albini *Historia Musculorum*, lib. iv.

* Albinus and Haller both speak doubtfully as to the muscularity of the *laxator. tympani;* a kind of diffidence more frequently to be met with in the more accurate and experienced anatomists than in those who are less qualified to decide.

na tympani is in various ways stretched and relaxed; the two first opposed to one another seeming to stretch and to relax it in different parts; at the same time stretching the part beyond the malleus, and relaxing that between the malleus and the place of their origin; the *tensor tympani*, on the other hand, seeming to produce a general tension, and the *stapedius*, by acting on the *malleus* through the os orbiculare and stapes, a general relaxation*; the whole also seeming to extend their functions to the labyrinth; for if one or more of the semicircular canals be laid open, and at the same time filled with water, the water will be seen to flow out during the tension, and to flow back again during the relaxation produced in the membrana tympani by their contractions. In the note below, the reader may see an account of their functions, as given by Albinus †.

* This function of the *stapedius* was first pointed out to me by an ingenious friend, Mr Alexander Walker.

† "*Externus mallei* malleum in priora trahit, modiceque porum acousticum versus; ex quo malleum sequens membrana tympani planior fit, et modice laxior, sed inæqualiter, maxime laxata illa parte quæ a priore parte mallei est.

"*Laxator tympani* mallei manubrium trahit retrorsum, simul et sursum, et porum acousticum versus; eoque membranam tympani eodem versus trahit, laxat, facitque planiorem.

"*Tensor tympani* mallei manubrium a poro acoustico retrahit ad oppositam tympani partem, et modice eodem tempore in priora; quo fit, ut cum malleum sequatur membrana tympani,

Remarks.

The auricle, the tympanum, and the bones of the tympanum, are wanting in many genera of animals, and different in many of the genera of animals in which they are found. As to their use, no one has yet pointed out precisely the relations and circumstances to which they are adapted, and far less the more obscure relations and circumstances to which their numerous varieties refer. In examining the ear, anatomists have bestowed but little attention on its physiology; they have rather chosen to labour, as it were, for the sake of labour; they have strained the eye, and pored through the microscope, not merely to discover the general form and structure of the organ, but to mark all its visible minutiæ, which they have named, and which they have described with as much solemnity as if their observations were to lead to some mighty discovery; as if trifles were important because they are true; or as if they could be raised to something of consequence by the minuteness of tedious description, or the pom-

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eam intro trahere valeat ac tendere, cavamque efficere a parte pori acoustici.

" *Stapedius* capitulum stapidis ad os cavernulæ, quo exit tendo sinis attrahit, eoque ita movet stapidem, ut pars posterior basis ejus in vestibulum auris introëat, prior ab eodem recedit." *Hist. Musculorum*, lib. iv.

pous parade with which they are announced as matters that have not been heard of before.

In treating of the motions of those parts that do not fall under the previous titles, Head, Neck, Trunk, or Extremities, I shall begin with the parts most atlantad; and, with as few exceptions as may be, proceed regularly to describe their motions as they occur in our progress sacrad.

CHAP. VIII

MOTIONS OF THE CUTIS COVERING PARTS OF THE CRANIUM AND THE FACE.

The parts of the cutis covering the face, and thence extending over the glabellar, the coronal, the inial, and the two lateral aspects of the cranium, seem the only parts of the human integuments, that, independent of the motions of bones. are made to change their relative positions in conse-

quence of the voluntary actions of muscles ¶. The changes are produced by the

Orbiculares Palpebrarum *,
Orbicularis Oris,
Epicranius, dexter et sinister *,
Corrugatores superciliorum *,
Levatores palpebrarum superiorum †,
Buccinatores ‡,
Zygomatici majores §,
Zygomatici minores §,
Levatores angulorum oris ‡,
Levatores labii superioris ‡,
Levatores labii superioris alarumque nasi ‡,
Nasales labii superioris ‡,
Depressores labii superioris alarumque nasi ‡,
Depressores angulorum oris ||,
Depressores labii inferioris ||,
Levatores menti ||,
Compressores narium ‡.

Of these muscles, the principal are the three *orbiculares*; all the rest being employed to moderate, assist, or direct them in shutting and opening. If they be shut by general contractions through the whole of their circumference, all their different diameters are shortened, but in different proportions: the parts opposite coronad and basilad being made

¶ I have never seen the ears, nor the integuments covering the two *latissimi colli*, moved by the separate and voluntary action of these muscles.

* See p. 168. † P. 173. ‡ P. 172.
|| P. 174. § P. 176.

to press against one another; but the parts opposite dextrad and sinistrad being prevented from reaching their centre by their attachments, either to bone, cellular membrane, or moderating muscles. While they are shutting, the moderating muscles, and the cutis around, are drawn toward each as toward a centre; and while they are opening, by the contractions of the moderating muscles (for sphincter muscles cannot open themselves), the cutis is seen receding around in different directions, as it were from a centre to a circumference.

Orbiculares Palpebrarum.

These muscles are most fixed toward the mesial angle of the orbit, to which point their superciliary fibres are drawn and directed by the *corrugatores superciliorum*. By their forcible contractions, they close the eyelids, and compress the eyeballs; cause the integuments to descend from the forehead, to ascend from the lips*, and to advance mesiad from the temples: Their moderators being the *epicranius*, the *levatores palpebrarum*, the *depressores labii superioris*†, and the *elastic cellular membrane* situated on the temples. When these act, the integuments

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* Assisted here occasionally by the moderators of the upper lip.

† Through the medium of the cutis and moderators of the upper lip.

again ascend by the forehead, descend by the cheeks, and return laterad towards the temples; causing thereby the eyelids to open, and the eyeballs to be freed from compression.

When the tendinous part of the *epicranius*, from the inflammation of cutaneous eruptions, or from other causes, adheres to the periosteum beneath, the hairy scalp becomes fixed in its situation; and the carneous fibres arising from the transverse occipital ridge, not being able to extend their influence to the cutis of the forehead, the wrinkles increase in depth and in number, and appear at an earlier period of life.

When the *corrugatores* and *orbiculares* act habitually with a greater force than the *epicranius*, the eyebrows are seen overhanging the orbits, with ridges and furrows more or less marked on the portion of the cutis which covers the glabella.

When the slender fibres of the two *orbiculares*, scattered on the eyelids, and by some denominated *musculi ciliares*, act independently of the larger fibres that encircle the orbits, they have respectively for moderating muscles the *levatores palpebrarum superiorum*. That motion of the upper or coronal eyelids, which from its suddenness has become proverbial, is the effect of these muscles acting alternately. By this motion, the lachrymal fluid is uniformly diffused over the corneæ, both its secretion and absorption promoted, the transparency and moisture of the corneæ preserved, and any

troublesome refractions of light, from particles of dust or accumulated tears, regularly prevented.

When the eyes are shut with a more than usual degree of force, or opened to a greater than usual extent, the larger fibres incircling the orbits, and their moderators, are brought into action; and if one of the eyes be thus shut and opened, and not the other, the lateral halves of the *epicranius* may then be seen to act as distinct muscles.

Orbicularis Oris.

Four muscles,

The two levatores menti, and

The two depressores labii superioris alarumque nasi,

cause the coronal and basilar parts of this orbicularis to meet, and to press, if necessary, against one another, in the shutting of the mouth; while the following muscles, as its moderators, and as intermixed with it at their insertion, draw it from the points within its circumference, open the mouth, enlarge its diameters, and draw the integuments towards their origins:

	Directions of action.
Nasales labii superioris,	Coronad, mesiad.
Levatores labii sup. et alarum nasi,	Coronad.
Levatores labii superioris,	Coronad.
Levatores angulorum oris,	Coronad, laterad.
Zygomatici majores,	Cor. lat. iniad.
Zygomatici minores,	Cor. lat. iniad.

	Directions of action.
Buccinatores,	Laterad, iniad.
Depressores angulorum oris,	Laterad, basilad.
Depressores labii inferioris,	Laterad, basilad.

The first four muscles, the *levatores menti* and *depressores labii superioris*, may be seen co-operating with the *orbicularis* when the mouth and cheeks are inflated with air, or when the lips are reflected inwards over the teeth, and again co-operating with its moderators when the lips are reflected dermad, or outwards.

Motions of the Nasal Cartilages.

Part of the cartilages forming the external orifices of the nostrils, as well as their integuments, are observed to change their relative positions by the actions of muscles. These two orifices dilate and contract, and some portions of the cartilages that form them are seen to ascend and descend a little between the mouth and the ossa nasi.

These motions are performed by the

Orbicularis oris,
Depressores labii superioris alarumque nasi,
Nasales labii superioris,
Levatores labii superioris alarumque nasi,
Compressores narium.

The coronal lip being previously fixed by its *depressores* and *orbicularis*, the *nasales labii superioris*, if thrown into action, draw the moveable part of the septum toward the mouth; when the *compressores*, attached at one extremity to the *depressores*, and

at the other to the ossa nasi, not being able to bring their extremities nearer by contraction, press on the lateral parts of the alæ, and force them mesiad; the same effects in these circumstances being likewise produced in a similar manner, and from similar causes, by the *levatores labii superioris alarumque nasi.* I have said, in these circumstances; as the only muscles that regularly cause the two alæ to approach the septum, are the *depressores* the *compressores narium*, and *levatores labii superioris alarumque nasi*, compressing the alæ only when the lip is fixed, but dilating them again when it is moveable; compressing them more when it is depressed, and dilating them more when it is elevated. To understand how the same muscles should thus perform such different functions, suppose two cords tied together on the ridge of the nose, and thence descending on each side over the alæ, and attached to their margin either by a piece of adhesive plaster or a blunt hook, yet descending beyond their attachment to the alæ as far as the mouth, and there tied again with a second knot; if their extremities at the mouth be moveable, and their other extremities be drawn coronad, or towards the brow, they will relax or corrugate the integuments upon the nose, and, by drawing the alæ coronad and laterad, will expand the nostrils. On the other hand, if the extremities at the mouth be fixed, or drawn at the same time in an opposite direction, the alæ will neither be raised nor depress-

ed, but forced mesiad toward the septum, and the two orifices of the nostrils diminished by lateral compression, just as they are by the pressure of the atmosphere, when the air is very suddenly inhaled, and the equilibrium between what is external and what is internal thereby destroyed.

General Remark.

Considering the extent of dilatation and contraction of which the *orbicularis oris* is susceptible; considering too, that wherever it is moved by its own contractions, the *levatores menti*, the *depressores labii superioris*, or its *moderators*, the integuments around, and to some distance, must always either precede or follow it; considering also, that the several parts of its circumference may be made to approach and made to recede in different directions, either in the lines of the muscular fibres, or in the diagonals of their different forces, and not only made to approach and recede, but to different extents, with different forces, different velocities, and in diagonals as varied as the changes of relative action, the modes of combination, or the orders of succession which twenty-three muscles may exhibit; considering maturely all these circumstances, we can hardly be surprised that the lips should assume, independent of the motions of the basilar maxilla, and independent of inflations by the breath, an almost incalculable va-

riety of forms; and that their muscles, combining their effects with those proceeding from the muscles of the nose, the eyes, the two *orbiculares palpebrarum*, and their moderators, should, for every shade of emotion and passion, furnish the countenance with means of expression next to inexhaustible.

CHAP. IX.

MOTIONS OF THE EYE *.

THE motions of the eye are,

Locomotions
- Iniad, and
- Glabellad;

Rotatory motions
- Coronad, and
- Basilad,

on axes extending between the mesial and the temporal aspect;

* The words *eye*, *auricle*, &c. preceded by the definite article *the*, are generally used as collective nouns, and denote what is plural.

Rotatory motions
Mesiad, and
Temporad,

on axes extending between the coronal and the basilar aspect;

And rotatory motions
Mesiad, and
Temporad,

on axes extending between the inial and glabellar aspect.

The muscles by which these motions are performed, are the

	Situation.	*Direction of action.*
Rectus attollens *,	Coronal,	Iniad.
Rectus depressor *,	Basilar,	Iniad.
Rectus adductor *,	Mesial,	Iniad.
Rectus abductor *,	Temporal,	Iniad.
Obliquus superior *,	Mes. coronal,	Glab. mesiad.
Obliquus inferior †,	Tempor. basilar,	Glab. mesiad.

The eye being every where imbedded in fat, except on the aspect where the cornea is situated, the motion *iniad* can be carried only to the extent in which the adipose substance is compressible. In this motion, the four *recti* act together in the double capacity of motors and directors, and the two *obliqui* in that of moderators; the *rectus attollens* resisting for the time the rotatory power of the *rectus depressor*; the *rectus adductor*, the ro-

* See p. 172. † P. 174.

tatory power of the *rectus abductor*; and the *obliquus superior*, the rotatory power of the *obliquus inferior*. In the motion *glabellad*, the two *obliqui*, resisting one another's rotatory powers, become the motors; and the four *recti*, moderators and directors.

In acting separately, these muscles perform only a rotatory motion, when each of the *recti* is moderated by the *rectus* of the opposite aspect, and the one of the two *obliqui* by the other. In such motions the *coronal rectus* is made to turn the pupil coronad; the *basilar*, basilad; the *mesial*, mesiad; the *temporal*, temporad; the *obliquus superior*, basilad and mesiad; the *obliquus inferior*, coronad and temporad: and as none of them can, in its separate motion, be moderated by any but its own moderator, it follows, that the four remaining muscles may act as directors; and that, therefore, the rotation of any one muscle may be variously combined with the rotatory motion of every other muscle, excepting that of its own moderator.

When the two *obliqui* act in succession, and are not restricted by the directing forces of the *recti*, they each roll the eye on a different axis, extending obliquely between the inial and glabellar aspects; and when the four *recti* act in succession, the eye is turned round, so as to describe the circumference of a cone, whose base is glabellad, and whose apex is pointed to the inial aspect.

By its six muscles, the eye, like the needle of

the mariner's compass pointing to the pole, preserves the same relative position with respect to its object, whether the object be in motion or at rest. And hence it is, that instead of the eye moving in the socket, we sometimes see the socket moving round the eye, and the eye quite still, performing its functions: And hence it is, too, that when the eyes are directed to an object that happens to be moving from right to left, or from left to right, the one eye is seen moving mesiad, and the other temporad, at the same time; the one eye having for its motor its *rectus adductor*, and the other for its motor its *rectus abductor*. The correspondence, therefore, of the motions in the two eyes is only what arises from their being directed to the same object—it does not depend on what might be called corresponding muscles; it does not depend on any connection of the optic nerves in the *sella turcica*, as the optic nerves send not even the shadow of a branch to the muscles of the eye; and it does not depend on the rays of light striking parts of the retinæ that are similarly situated;—for, when the rays enter the pupils by the right or left, they fall on those parts of the retinæ that are respectively mesiad in one eye, and temporad in the other.

When the motions of the eyes are too limited for the sphere of vision that may be required, the motions of the head, neck, and trunk, are made to co-operate; and the centre of motion and the centre of gravity in the human body frequently

coinciding, these several parts can be turned round with such a rapidity dorsad, sternad, dextrad, and sinistrad, that the visible canopy above and below, with the earth, that seems bounded by the horizon, may in every direction be viewed in a portion of time so minute, that what is successive appears instantaneous. In the lower animals, where gravity acts perpendicular to the plane in which the axis of the body is situated, Nature, which is always fertile in expedients, has recourse, if extensive vision be required, to other contrivances of different kinds. In some, where the two flexions of the trunk dextrad and sinistrad are comparatively slow, the eyes are placed on the two lateral parts of the head, and assisted by the flexions and rotations of the neck: In some, where the motions of the neck are wanting or very imperfect, we observe the eyes, on moveable pedicles, projecting from the surface, as in crabs and lobsters: In some, again, where the eyes themselves are destitute of motion, their number is increased, and eyes are scattered either on the different aspects of the head, as they are in spiders; or collected together in vast quantities in the two lateral parts of the head, forming convex surfaces, with aspects pointing atlantad, sacrad, sternad, dorsad, dextrad, and sinistrad, as in the *libellulæ*, and a variety of winged insects: In short, the eyes, with respect to motion, situation, and number, have a reference to the form and structure of the animal; as these,

again, have a reference in their turn to various functions, relations, and circumstances, which the animal more accurately discovers by instinct, than the physiologist by his profound and laborious researches.

Some have imagined that the muscles of the eye vary its form, and accommodate its vision to different degrees of magnitude and distance, of which some vague and general information is previously communicated by impressions on the retina. That animals judge of magnitude and distance partly by the eye, and antecedent to any experience by the sense of touch, is not improbable, from the birds and quadrupeds that walk and run, from the fishes that swim, and the insects that fly, immediately after birth. At that period a number of animals seem to distinguish, by the sight alone, not only the relative situations of objects, but the different degrees of magnitude and distance, as accurately as at any period of their lives; and that they are instinctively led to these distinctions, merely by the difference of lights and shades, may be fairly presumed from the gross mistakes to which they are liable with respect to pictures. From the eye, however, being fitted to convey notions of great magnitudes and distances by a momentary glance of lights and of shades, and from the touch conveying notions of only small magnitudes and distances, and these notions by the repetitions of actual

contact at successive and measurable periods of time, we may easily conceive, that a person, accustomed for a number of years to form the notions of magnitude and distance by the sense of touch, would be very much puzzled to reconcile the habits and notions derived from that sense with the first impressions which he afterwards derived from the sense of sight; and as it is only in consequence of experience, that he can infer, from the sight of an object, what are the impressions that it would make on the sense of touch; or that he can infer, from the touch of an object, what are the impressions that it would make on the sense of sight, it is not surprising that our inferences here should be always fallacious, whenever our experience is limited or defective.

That the human eye varies its form to examine objects of different magnitudes, at different distances, and in different lights, is what probably few will deny; but that the variation is produced by its straight and oblique muscles, is an opinion not so easily believed. These muscles seem chiefly intended to roll the pupil in different directions; and therefore, in cases where they are wanting, the eyes, to secure an extent of vision, if an extent of vision be requisite, are multiplied in situation and number.

From the great hardness of the tunica sclerotica in the eyes of birds, the muscles can produce no direct change either on the cornea or the hu-

mours within; nor can it be demonstrated that they are capable of producing such a change in the eyes either of man or of quadrupeds. In such functions they could not be assisted by the motions of the head, the neck, or the trunk; and their loss to the eyes could not be compensated by an increase of number, by varied situation, or by moveable pedicles. If they really produce a change of form in the human eye, they in one respect certainly differ from all other muscles. In most individuals, at an advanced period of life, and in many during their infancy and youth, they perform their functions with so little effect, that they require the assistance of glasses, from their want of ability to increase or diminish the convexity of the cornea.

In the feathered tribes, a ring composed of osseous plates, and uniting the sclerotic coat and the cornea, is capable of being dilated and contracted by the action of the iris in its dilatation and contraction of the pupil. By a similar action, the ring formed by the ciliary plicæ, where they incircle the body of the lens, may also be either dilated or contracted in the human species. When it is contracted, the axis of the eye, extending from the pupil to the optic nerve, will be somewhat elongated; the part of the humours that happens to be iniad will be pressed more iniad, and that towards the pupil still more glabellad, by the tightening of the zone. A contrary effect will

be produced when the ring is dilated; and both effects will have their influence in varying the form of at least one part of the vitreous humour, in affecting slightly the situation of the lens, and in changing the proportion between the anterior and posterior chamber of the aqueous humour. That the pupil is made to dilate and contract in performing certain functions of vision, is what no physiologist has yet denied. The question is only, whether are these changes produced by muscles; by a sphincter, for instance, and its moderators? a question that still remains undecided.

The effects here ascribed to the iris have been ascribed by Dr Porterfield to the ciliary plicæ. Now the Doctor imagined, not only that these plicæ were muscles, but also that they run from the ciliary ligament towards the lens in an inial direction: A singular opinion for an author of such accuracy, ingenuity, and learning; as the first hypothesis cannot be demonstrated, and as the second is so totally unfounded, that a cursory inspection of a recent eye is sufficient at any time to prove the contrary.

The iris, however, besides producing changes in form and in situation by its contractions and dilatations, has another office of no less importance: I mean the office of regulating the quantity of light that is admitted, in proportion to the magnitude or distance of the object, the quantity of light reflected from its surface, or the sensibility of the

eye at the time. In this office it is assisted by the eyelids and eyelashes; and so much has been ascribed to its action in this way, that any other change, to fit the eye for distinct vision at different distances, has by some physiologists been thought unnecessary.

But, considering the powers by which the eye varies and modifies its sphere of vision, and renders the cornea more or less convex, there is one reflection that must unavoidably occur to every one; a reflection on that gradual diminution of the cornea's convexity induced by old age: What is the reason that the iris, and muscles possessing apparently all their original functions and powers, cannot obviate this change? Or, when the iris is too convex, as in some individuals during the earlier periods of life, what is the reason that the iris and muscles cannot lessen the convexity so as to render glasses unnecessary in examining the greater magnitudes and distances? Can this be owing to a change in the quality, or rather to a change in the quantity of the humours? That it is owing to a change in the quantity, is more than probable, from the flattening of the cornea in consequence of age; a period when the customary fluids of the body cease to bear that proportion to the solids, which they did in the dawn and noonday of life. It is probable, too, from the nature of the glasses that are found to remedy the defects of vision, and probable from the time which the eye

requires to accommodate itself to different lights, magnitudes, and distances. In passing suddenly from darkness to light, or from light to darkness, or in viewing accurately one object after another, at different distances and of different magnitudes, although we be conscious that the eye necessarily undergoes a change, we are conscious also that the transition is gradual and slow, and unlike the usual effects of the muscles. To account for such transitions, we have to recollect, that the eye, independent of any direct muscular action, is made to assume different appearances under the influence of different passions, different appearances in different diseases, and even in the different periods of life; and that, consequently, much of these appearances must always depend on the state of circulation, and on that mutual relation of action between the sanguiferous and absorbent vessels; a kind of relation that may be varied by emotion and passion, by local irritation, by muscular action, and by other causes. That the humours of the eye support the cornea, and give it convexity, is proved from what we regularly observe in extracting the lens. That a little more than the usual quantity of fluid in the vessels, gives always an additional convexity to the cornea, is proved from injecting the ophthalmic veins with water or mercury; a drop or two of either of these fluids rendering the whole eyeball hard, and the cornea so tense that it loses its transparency, and, in point

of colour, resembles a mixture of water and milk. That the veins of the eye may be more or less distended by the state of circulation, is proved from inflammation: and that the cornea may be more or less distended from a similar cause, is proved by the pain arising from tension, and which is relieved by discharging a part of the aqueous homour*; and proved, also, from an opacity that sometimes pervades it in a few hours, and which may occasionally be afterwards removed by bleeding and purging†. That the aqueous humour enters the eye partly at the angle that is formed between the iris and cornea, may be demonstrated by a mercurial injection of the veins; while that injection may also show whether the iris be convex or plane. That the aqueous humour is constantly flowing into its chambers, is probable from that which takes place after death, when the supply not being equal to the expenditure, the cornea collapses, and becomes dim. That it flows into these chambers in considerable quantity, may be presumed from the shortness of the time in which it fills not only the places destined for itself, but the places of the lens and the vitreous humour, after these are discharged. That the action of the muscles which

* See a paper of Mr Wardrop's in the Edinburgh Medical and Surgical Journal, No. IX.

† See Dr Edmonston on Ophthalmia, p. 173.

surround the vessels upon the peripheral aspect of the eye, may have some effect, though not a direct one, in regulating its influx, and in that way the convexity of the cornea, is not unlikely. For, if the blood return not by the veins as fast as it flows in by the arteries, a greater quantity of that which is transparent will be forced into the vessels that terminate in the cavities and upon the surface. Now the current of the blood returning from the orbit by the veins of the face, being partly retarded by the contraction of the *orbicularis palpebræ*; and the currents of the veins, passing through the *foramen lacerum* by the contractions of the four *recti*, it is probable that these muscles act with a much more than ordinary force, when we are examining minute or near objects, where a greater convexity of the cornea is required, and with very little force, and that too but a moderating force, when we are examining objects at a distance. If in this way they produce not the convexity that may be required, it is because the convexity depends but partly on their action; depending more on the state of circulation, and on that irritability of the system through which the vital principle instinctively regulates the functions. Whence, in the later periods of life, when the sensibility of the system is diminished, when the circulation of the fluids is languid, when the supply furnished is less, and the waste greater,—the cornea loses a part of its convexity, which no action of the mus-

cles can restore. The like causes may be seen operating on the sexual organs. In the evening of life, the memory may recal, and imagination attempt to revive, those mental emotions, by which they grew turgid, to perform their functions; but the system then will plead irresistibly, that the time is past; that the streams of life are but scantily supplied; and that the organs, like the sapless leaves withering in autumn, are hastening to decay.

CHAP. X.

MOTIONS OF THE BASILAR MAXILLA.

These motions are,

Coronad,
Basilad,
Antiniad,
Iniad,
Dextrad,
Sinistrad.

Coronad and basilad. In motions directly coronad and basilad, the condyles move out and into their sockets in lines perpendicular to the base of the cranium. In many animals, where the jaw is hinged in the osseous structure, these motions cannot

be performed; nor the two motions antiniad and iniad, nor the two motions dextrad and sinistrad, where the condyles move round a common centre.

In the ginglymus motions coronad and basilad, employed in the shutting and opening of the mouth, the maxilla is moved upon an axis passing transversely through its two condyles.

Or, if the condyles during these motions be moved alternately antiniad and iniad, they are moved upon an axis passing transversely through the necks of the condyles.

Antiniad and iniad. In these motions the condyles are made to change their situations, not only by moving antiniad and iniad, but also by moving in a slight degree basilad and coronad; basilad, when they leave their articular cavities to move antiniad; and coronad, when they return to their place.

Dextrad and sinistrad. In these motions the condyles slide dextrad and sinistrad in lines perpendicular to the lateral aspects; in which case one of the condyles will be moving mesiad, and the other laterad, at the same time.

Or both condyles will move in the segments of concentric circles, described round a centre alternately situated in the two rami; while the planes of the circles will either be parallel, oblique, or perpendicular to the base of the cranium.

When parallel or oblique, the centre of motion will be in an axis perpendicular or inclined to

the base of the cranium, and more or less removed from the middle part of the condyle towards the coronoid process of the ramus in which the centre of motion is situated.

When perpendicular, the centre of motion will be more or less mesiad of the condyle which is nearest the centre, a little basilad towards its *cervix*, and situated in an axis extending antiniad and iniad in a plane that is parallel to the base of the cranium. This motion, however, must be rare, as few individuals can open the jaw wider at the one side than at the other, and never to any very obvious extent.

If the two condyles were to move either dextrad or sinistrad in the circumference of the same circle, and the chin to move in an opposite direction round the same centre, that centre would be equidistant from the two rami, but not farther antiniad than the rami. This motion also, if ever it occur, must occur very seldom: for, when the jaw moves dextrad and sinistrad, and parallel or oblique to the base of the cranium, the two condyles move in the segments of concentric circles; the one iniad and mesiad, the other antiniad and laterad, at the same time.

If the centre of motion were to retain a stationary place in one of the condyles, the other condyle would be made to move in the segments of circles, whose planes are parallel, oblique, or perpendicular to the base of the cranium. But

from the shape of the condyles and their cavities, and from the attachments of the different muscles, I am not certain that these motions ever are performed, or can be performed.

In no case is the centre of motion ever to be found in any part of the basilar maxilla lying between the symphysis and rami, and never consequently can either the centre or the axis of motion be placed at a distance from both condyles at the same time.

The muscles by which these motions are performed, are the

	Directions of action.
Temporales *,	Coronad, mesiad, iniad, antiniad †.
Masseteres *,	Cor. lat. antin. iniad †.
Pterygoidei interni *,	Cor. mes. antiniad.
Pterygoidei externi *,	Basilad, mes. antiniad.
Latissimi colli *,	Bas. lat. iniad.
Biventres maxillæ *,	Bas. lat. iniad.
Mylohyoidei *, §,	Bas. mes. antiniad.
Geniohyoidei *, §,	Bas. iniad.
Geniohyoglossi *,	Bas. iniad.

The three last pairs, in order to act with any force on the basilar maxilla, require the os hyoides to be fixed or drawn sacrad ‡; and even then they can move it only iniad and basilad; the

* See p. 176. § See note p. 316.

† Some fibres of the *temporales* draw coronad and antiniad, and some of the masseteres coronad and iniad.

‡ See p. 317.

mylohyoidei having no power to move it dextrad, sinistrad, or antiniad; having no fixed point but the os hyoides, and themselves contributing to fix that point between the two halves of the basilar maxilla, depressing the maxilla through the *geniohyoidei* *, but exerting no force dextrad, sinistrad, or antiniad, that can be directly or indirectly extended over an articulation.

The five last pairs, whose directions of action may either be expressed in terms alluding to the aspects of the head or the aspects of the trunk, are all attached at some distance antiniad of the rami; and though incapable of drawing the condyles antiniad or basilad, yet they are able to depress the chin with considerable force, compensating the want of physical strength by the length of their levers.

In all the motions of the basilar maxilla, the coronal forces moderate the basilar; the antinial, the inial; the lateral, the lateral; and the mesial, the mesial of the opposite sides.

In all lateral motions, however, the mesial forces moderate the lateral of their own side, combining with the lateral of the opposite; and, *vice versa*, the lateral forces, combining with the mesial of the opposite side, moderate the mesial of their own side.

* See p. 316.

Motions directly Coronad and Basilad.

In these motions the coronal forces of the *temporales*, the *masseteres*, and *pterygoidei interni*, and the basilar forces of the *pterygoidei externi*, are alternately the motors and moderators; the antinial and inial forces of all the muscles, and the mesial and lateral of all the muscles, excepting those attached at one extremity to the os hyoides, being the directors. For obvious reasons, the motion basilad in this case can never be carried to any very perceptible extent without danger; and hence we find there are no forces which can draw the condyles directly basilad, without the direction of the powerful muscles that draw them coronad; which muscles acting at a small distance from the two condyles, never, unless when taken by surprise, allow the condyles to be moved so far out of their place in the basilar direction as to expose them to the danger of luxation.

Ginglymus Motions Coronad and Basilad.

When the axis passes transversely through the condyles.

In these motions the coronal forces of the *temporales*, the *masseteres*, and *pterygoidei interni*, and the basilar forces of the *latissimi colli*, the *biventres maxillæ*, the *mylohyodei*, the *geniohyoidei*, and *genio-*

hyoglossi, are alternately the moderators and motors; the inial and antinial forces of all the pairs, and the mesial and lateral of all the pairs, excepting those attached at one extremity to the os hyoides, being the directors.

When the axis of motion passes transversely through the necks of the condyles.

In these motions the mesial and lateral forces only are directors; the antinial and inial, as well as the coronal and basilar forces, being alternately motors and moderators: the *pterygoidei externi* drawing the condyles in the opening of the jaw antiniad and basilad; while all the basilar and coronal forces that draw toward the inial aspect combine in restoring them to their situation.

Motions Antiniad and Iniad.

The *pterygoidei externi* are principally concerned in the motion antiniad, assisted at the commencement of their action by the *pterygoidei interni*, and by part of the *temporales* and *masseteres*, moderated, however, from first to last, by the *latissimi colli* and *biventres maxillæ*; or, if the os hyoides be a fixed point, by the *mylohyoidei*, the *geniohyoidei*, and the *geniohyoglossi*: the coronal and basilar forces of all the muscles, and the mesial and lateral of all the muscles, excepting those attached at one extremity to the os hyoides, being the directors.

Motions Dextrad and Sinistrad.

Simply dextrad and sinistrad.

In these motions the mesial and lateral forces of all the muscles, excepting those attached at one extremity to the os hyoides, are alternately motors and moderators*, the other forces being the directors.

When the condyles move round a common centre in planes parallel, or nearly parallel, to the base of the cranium.

In these motions, as one of the condyles is always moving iniad and mesiad, while the other is moving antiniad and laterad, the inial and antinial forces, with the mesial and lateral, excepting as above, being necessarily either moderators or motors, the only directors will be the coronal* and basilar forces.

When the condyles move round a common centre in planes perpendicular to the base of the cranium.

In these motions, the whole mesial and lateral forces, with the previous exceptions, the whole of the coronal forces, and the basilar forces of the two *pterygoidei externi*, are employed as moderators or motors, the inial and antinial being the directors.

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* How they moderate and assist, see p. 486.

CHAP. XI.

MOTIONS OF THE TONGUE*.

THESE motions are,

Dextrad,
Sinistrad,
Antiniad,
Iniad,
Coronad,
Basilad ;

motions also by which it is varied in

Length,
Breadth, and in
Thickness ;

and motions by which it is

Folded,
Coiled, and
Inflected

in different directions.

By the two motions *dextrad* and *sinistrad*, it is moved alternately from side to side.

* In Greek γλωσσα, a word forming part of the names of most of the muscles belonging to the tongue.

Some of the muscles performing these motions diverge from the mesial line of the tongue towards the sides; and when their dextral and sinistral halves happen to act at the same time, they draw the sides to the mesial line, increase the length or thickness of the tongue, but diminish its breadth. When they act alternately, the one on the right moves the tongue towards the left; and, *vice versa*, the one on the left towards the right.

By the motion *antiniad*, the tongue is pushed towards the lips, or out of the mouth:

By the motion *iniad*, drawn towards the fauces:

By the motion *coronad*, pushed against the palate:

By the motion *basilad*, drawn from the palate to the os hyoides.

These six motions are frequently combined with motions proceeding from the os hyoides, and are performed by the

	Directions of action.
Styloglossi*,	Coronad, iniad, laterad.
Hyoglossi†, ‡,	Basilad, iniad, mesiad.
Geniohyoglossi ‡,	Antiniad, iniad, basilad, mesiad.

The *styloglossi* draw the tongue towards the fau-

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* See page 169.

† The *hyoglossi* include the *ceratoglossi*, the *basioglossi*, and the *chondroglossi* of Albinus.

‡ See p. 177.

ces, increase its breadth at the place of their insertion, and, raising it a little towards the palate, contribute to diminish the isthmus faucium. When they act alternately, they move it successively dextrad and sinistrad; and then are assisted, or may be assisted, by the *hyoglossi* and *geniohyoglossi*, the dextral halves of these pairs co-operating with the sinistral of the *styloglossi*; and, *vice versa*, the sinistral, with the dextral.

The *hyoglossi* draw the tongue towards the fauces, depress its sides, diminish its breadth, make it convex coronad, and concave basilad, along the course of the mesial line; and, by drawing it basilad to the os hyoides, contribute to enlarge the isthmus faucium.

The *geniohyglossi*, arising from the symphysis menti, enter the basilar aspect of the tongue on each side of the mesial line; and from their origin are observed to extend their radiated fibres antiniad, iniad, coronad, laterad, and even to the os hyoides itself, to the epiglottis, and a part of the pharynx: By these means they draw the tongue into the mouth, push it out of the mouth, raise it, depress it, move it from one side to another, diminish both its length and its breadth; or if so willed, make it convex basilad, and concave coronad, along the course of the mesial line. As viewed in relation to the *hyoglossi*, in a general sense, they agree with these muscles in diminishing the breadth and length of the tongue, or in giving it length by di-

minishing its breadth and adding to its thickness. They agree with them also in moving it from one side to another, and very frequently in drawing the apex towards the fauces. They oppose them, however, in the inial and basilar motion of the tongue between the symphysis menti and the os hyoides, vary their action, and moderate them often in drawing the apex towards the fauces, and always moderate them when they render the tongue concave basilad, or contract to enlarge the isthmus faucium. And yet, various and numerous as their actions are, they can hardly, though assisted by the *styloglossi* and the *hyoglossi*, satisfactorily account for all the singular movements of the tongue: And hence it is, that, besides the fibres properly belonging to these muscles, we observe fasciculi on the lateral aspects of the *geniohyoglossi* running longitudinally between the two extremities of the tongue, and which have been named *musculi linguales*; and on more minute and accurate inspection, a number of short disgregated fibres, dispersed every where through the substance of the tongue, and called by Malpighi and Du Verney, who have pictured them,

Fibræ longitudinales,
transversales,
perpendiculares.

These fibres, though often in the same general direction and the same stratum with those of the *hyoglossi* and *geniohyoglossi*, are however distinct, have

separate actions, and these actions confined to particular parts of the tongue where they are situated. In their several situations and strata, contracting and relaxing as the will inclines, and giving their assistance to the *styloglossi*, the *hyoglosi*, the *genio-hyoglossi*, and the *linguales*, the whole of the tongue may be made rigid, or the whole flaccid; or one part rigid, and another flaccid, at the same time. For instance, the mesial line may be made flaccid and the sides rigid, so that the sides shall fold together on the flexible part, as upon a hinge; or a transverse line may be made flaccid, and the rest rigid, so that the apex shall move, as on a joint, dextrad, sinistrad, coronad, basilad; or by the varied and successive action of the different fibres, the whole may be widened, lengthened, thickened, narrowed, shortened, and made thinner in the twinkling of an eye; the apex darted out of the mouth with more rapidity than the sight can follow it, and then with the same rapidity drawn back in a straight line, or coiled up like the tongues which we see in the genus Rana. By the same powers, the whole tongue may be made elastic, and when put in motion by the air from the lungs, may be made to vibrate like the string of an instrument, as in the continued pronunciation of *r*.

The variety, the velocity, the force, the extent, and the combinations of the motions of the tongue, owing to the power which the animal possesses of distributing to the whole, or to any given part, its ner-

vous energy, in various degrees of quantity, intensity, rapidity, and duration, render its motions truly astonishing. And yet, independent of all these motions, by which it assists in mastication, deglution, and speech, its substance is such as to admit of that distribution of glands and papillæ as to render it the principal organ of taste.

CHAP. XII.

MOTIONS OF THE OS HYOIDES.

THOUGH the os hyoides be not necessarily affected by the motions of the tongue, yet the tongue, more or less, must always be affected by the motions proceeding from the os hyoides.

These motions are,

Atlantad,
Sacrad,
Sternad,
Dorsad,
Dextrad,
Sinistrad;

or in some of the intermediate directions; and the muscles which perform them, are the

	Directions of action.	
Biventres maxillæ *,	At dor laterad.	At. ster. mesiad.
Mylohyoidei *,	At. laterad.	
Geniohyoidei *,	At. sternad.	
Geniohyoglossi *,	At. sternad.	
Stylohyoidei *,	At. dor. laterad.	
Coracohyoidei *,	Sac. dor. laterad.	
Sternohyoidei *,	Sac. laterad.	
Thyrohyoidei *,	Sac. mesiad.	

Atlantad and sacrad. In these motions, the atlantal and sacral forces are alternately the moderators and motors; the sternal and dorsal, the dextral and sinistral forces, the directors.

Sternad and dorsad. The sternal and dorsal forces, alternately moderators and motors; the atlantal, sacral, the dextral and sinitral forces, the directors.

Dextrad and sinistrad. The dextral and sinistral forces alternately moderators and motors; the atlantal and sacral, the sternal and dorsal, the directors.

As all these motions of the os hyoides are in the diagonals of different forces, seeing no muscles singly or in pairs are capable of moving the os hyoides in any one of the above directions; as all

* See p. 177.

the diagonals, too, may be varied by varying the relative proportion of the forces by which they are produced; and as all the muscles of the os hyoides are capable not only of varied action, but of varied combination—it necessarily follows, that the os hyoides may move in several other diagonals: It may move, for instance, atlantad and dextrad, atlantad and sinistrad, or atlantad and mesiad; sacrad and sinistrad, sacrad and dextrad, and then sacrad and mesiad; or first laterad, and then atlantad; or laterad, and then sacrad; or first atlantad or sacrad, and then dextrad or sinistrad, and afterwards mesiad. In short, the os hyoides, by means of its muscles, is susceptible of as many changes of position, and of moving in as many different directions, as a ball would be if placed in the centre of a hollow sphere, with cords proceeding in every direction to the circumference, and capable of moving it with different forces, either in the lines of their own direction, or in diagonals to any given point in the surface of the sphere.

CHAP. XIII.

MOTIONS OF THE LARYNX.

The larynx is partly composed of five cartilages, which are the *cricoid*, *thyroid*, the two *arytænoid*, and the *epiglottis*.

The muscles attached to the cricoid cartilage, are the

Crico-thyroidei,
Crico-pharyngéi,
Crico-arytænoidei postici,
Crico-arytænoidei laterales.

The muscles attached to the thyroid cartilage, the

Crico-thyroidei,
Sterno-thyroidei,
Stylo-thyroidei,
Thyro-hyoidei,
Thyro-epiglottidei,
Thyro-arytænoidei,
Thyro-pharyngei,
Thyro-staphylini.

The muscles attached to the two arytænoid cartilages, the

Crico-arytænoidei postici,
Crico-arytænoidei laterales,
Thyro-arytænoidei,
Arytænoidei obliqui,
Arytænoidei transversi.
Arytæno-epiglottidei.

The muscles attached to the epiglottis, the

Arytæno-epiglottidei,
Thyro-epiglottidei.

Connected with the motions of the tongue and os hyoides are many of the larynx and the trachea *. When the tongue is moved antiniad or coronad, and the os hyoides atlantad or laterad, the position of the larynx is necessarily changed, the trachea elongated, and the membranes between its cartilages stretched. On the other hand, when the os hyoides is moved sacrad, and the tongue drawn iniad and basilad, the larynx also is moved sacrad, the trachea shortened, and the membranes connecting its cartilages relaxed. The larynx and trachea are drawn atlantad, and their membranes rendered tense during deglutition,

* When, prior to Galen, all arteries were supposed to be air vessels, the windpipe, for distinction, was called αρτηρια τραχεια, or rough artery. *Trachea*, therefore, should always be pronounced with the *e* long, and not short, as is usually the practice.

and are both likewise variously affected, by the motions of the neck: For as both lie on its sternal aspect, their connecting membranes must be stretched and elongated when that aspect is rendered convex by the inclinations of the neck dorsad; shortened and relaxed by the inclinations of the neck sternad; and varied by those inclinations that are laterad.

Besides the muscles affecting the state or position of the larynx, through the medium of the neck, os hyoides, or tongue, there are several muscles which are principally intended to vary the relative position of its cartilages; to widen, regulate, or close up the space between the epiglottis and the thyroid cartilage; to relax and give tension to the two ligaments forming the glottis; to enlarge and diminish the aperture between them in length and in breadth; and at the same time to produce indirectly similar changes on the membranous folds that constitute what is called the *spurious glottis*, and which, with the ligaments of the true glottis, contribute to form the lateral depressions that have been denominated the ventricles of the larynx, or the ventricles of Morgagni. The muscles destined to produce these changes, are the

	Directions of action.
Thyro-hyoidei,	At. laterad.
Stylo-thyroidei *,	At. lat. dorsad.
Sterno-thyroidei,	Sac. laterad.
Crico-thyroidei,	Sac. mesiad.
Thyro-epiglottidei,	Sac. sternad.
Thyro-arytænoidei,	Sac. lat. sternad.
Crico-arytænoidei postici,	Sac. lat. dorsad †.
Crico-arytænoidei laterales,	Sac. lat. sternad.
Arytænoidei obliqui,	Mesiad.
Arytænoidei transversales,	Mesiad.
Arytæno-epiglottidei,	Sac. dor. mesiad.

Some authors have mentioned likewise the *glosso-epiglottidei* or *glosso-epiglottici*, which are seen in some quadrupeds, but seldom in man; and then they are only a few scattered fibres of the *genio-hyoglossi*. Others have divided the *thyro-epiglottidei* into two pairs, although there be often a considerable difficulty in demonstrating one pair. No author, so far as I know, or at least recollect, seems to have ascribed any motion of the larynx to the *crico-pharyngei* or the *thyro-pharyngei*, although they contribute not only to fix it, but to change its position; and the *thyro-pharyngei* to draw the two

* Stylo-pharyngei of Albinus.

† Instead of laterad, they would seem to draw mesiad, if we did not attend to the mode of their insertion, or ascertain their effect by experiment.

sides of the thyroid cartilage, not merely atlantad and dorsad, but likewise mesiad. Among the motors of the thyroid cartilage, I have not enumerated the *thyro-staphylini*, as those changes which they seem to produce are confined principally, if not entirely, to the isthmus faucium.

The ligaments of the glottis, stretching dorsad from the thyroid cartilage to the two arytænoid, are rendered tense by those muscles that draw the thyroid cartilage sternad, or the arytænoid dorsad, and relaxed by those that draw the thyroid dorsad, or the arytænoid sternad.

The aperture between the ligaments is widened by the muscles that draw the arytænoids laterad, narrowed by those that draw them mesiad, lengthened by those that draw them dorsad, and shortened by those tha draw them sternad.

When the dorsal and mesial forces, acting on the two arytænoid cartilages, combine, the ligaments are stretched, the length of the aperture between them increased, and the breadth diminished.

When the sternal and latera: forces combine, the breadth of the aperture is increased, its length diminished, and the ligaments relaxed.

The space between the thyroid cartilage and the epiglottis is varied, partly by the thyro-epiglottidei and the thyro arytænoidei, partly too by the motions of the tongue and the thyroid cartilage. When the tongue is drawn iniad or basilad, or the thyroid cartilage atlantad and sternad.

in such a manner that this cartilage and the os hyoides are brought nearly into close contact, the epiglottis shuts the orifice of the larynx, as in deglutition; and in all cases this orifice, restricted however to certain limits, is greater or less according to the force and extent of the action employed by the muscles.

CHAP. XIV.

MOTIONS OF THE PHARYNX.

Commencing at the basilar aspect of the cranium, lying sternad of the atlas and vertebra dentata, and extending sacrad to where the trachea is continued from the larynx, is the membranous sack which is named *pharynx*. On the peripheral aspect of this sack, dorsad and laterad, are seen a number of carneous fibres proceeding from the sides, in most places a little atlantad, and meeting dorsad at the mesial line. The parts from which the fibres originate, are

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The cuneiform process of the occipital bone,
The petrous portions of the temporal bones,
The pterygoid processes of the *sphenoides*,
The two *circumflexi palati*,
The *buccinatores*.
The two sides of the basilar maxilla, not far from the teeth which the Greeks called μυλαι,
The *geniohyoglossi*, where they enter the tongue,
The two cornua of the os hyoides,
The sides of the ligament between the os hyoides and thyroid cartilage,
The *stylo-thyroidei*,
The lateral parts of the thyroid cartilage, and
The lateral parts of the cricoid cartilage, where these are not covered by the thyroid cartilage.

The whole of these fibres have by anatomists been divided into groups, although the groups arising from the muscles have not been distinguished by separate names, but have either been named from parts in the vicinity, or referred to the other origins enumerated. The whole of these groups, by a classification that was generally adopted prior to Albinus, amounted to eight; and, with an allusion to their opposite attachments, are the

Cephalo-pharyngei*,
Pterygo-pharyngei *,
Mylo-pharyngei *,
Glosso-pharyngei *,

* From the *constrictor superior pharyngis* of Albinus.

Hyo-pharyngei †,
Syndesmo-pharyngei †,
Thyro-pharyngei ‡,
Crico-pharyngei ‡.

While the whole are calculated to contract the pharynx, those attached to the os hyoides and the cartilages of the larynx move them a little atlantad and dorsad; and, consequently, contribute not only to compress, but to fill up the cavity of the pharynx. This cavity communicates with the stomach by the œsophagus, a cylindrical tube, properly a continuation of the pharynx itself, and surrounded with circular carneous fibres called œsophageal.

It communicates also with the pulmonary vesicles through the larynx, trachea, and the bronchial tubes;

With the tympana of the ears, through the tubes of Eustachius;

With the frontal, sphenoidal, and maxillary antres, through the two inial apertures of the nostrils; and

With the mouth, through the isthmus faucium.

† From the *constrictor medius pharyngis* of Albinus.
‡ From the *constrictor inferior pharyngis* of Albinus.

CHAP. XV.

MOTIONS OF THE VELUM PENDULUM PALATI.

Between the mouth and the two inial apertures of the nostrils, is situated the velum pendulum palati. When the mouth is opened, it is seen extending from right to left in the form of an arch, with the staphyle or uvula suspended in the middle. From this middle point, towards right and left, it immediately separates into two folds, gradually diverging till they reach the lateral parts of the tongue. The antinial fold is usually known by the name of the *anterior*, and the inial by that of the *posterior* arch. The amygdala or tonsils are observed between them, secreting a mucous lubricating fluid, that moistens the lateral parts of the tongue where they are situated. The passage through the arch is the isthmus faucium; and to prevent the currents of air that flow through this

passage from drying the mesial parts of the tongue that are not moistened by the amygdala, the tongue, where it lies under the arch, is furnished with a number of mucous glands, while the staphyle or uvula conveys to the parts near the mesial line, which would otherwise be less liberally supplied, a considerable part of the moisture of the palate; a moisture which, were it not for the uvula, would, in animals assuming the erect posture, be conducted along the sides of the arch to the margin of the tongue and to the amygdala, where its aid is not required. And hence it is, that a change of position, answering those purposes intended by the uvula, the uvula is wanting in the pendulous velum of all those animals whose antinial aspect is regularly directed towards the ground.

All the muscles belonging to the *velum*, terminating in the staphyle, or mesial line where the staphyle is situated, those anatomists who have chosen to express them by names alluding to their attachments, have naturally called them the

Staphylini *,
Glosso-staphylini †,
Thyro-staphylini ‡,

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* *Azygus uvulæ* of Albinus, yet not a muscle but a pair of muscles. See page 14.

† *Constrictores isthmi faucium* of Albinus.

‡ *Palato-pharyngeus* of Albinus.

Spheno-staphylini §,
Petro-staphylini ||.

The *staphylini* draw the staphyle to the palatine suture, diminish the breadth of the pendulous velum at the mesial line, and enlarge the isthmus by elevating the middle part of the arch.

The *glosso-staphylini* draw the staphyle basilad and laterad towards the tongue, extend the breadth of the pendulous velum at the mesial line, and diminish the isthmus by lowering the middle part of the arch.

The *thyro-staphylini* draw the staphyle basilad and mesiad, increase the breadth of the pendulous velum toward the sides, and diminish the isthmus chiefly in width.

The *spheno-staphylini* pass over a pulley, draw the staphyle directly laterad, stretch the velum, bring it to nearly the same plane with the palatine plate of the palate bone, destroy almost the appearance of the arch, and in every direction enlarge the isthmus.

The *petrostaphylini* draw the staphyle coronad and

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§ *Circumflexi palati* of Albinus.

|| *Levatores palati mollis* of Albinus. The two last pairs, from an attempt to render their names minutely descriptive, have with some anatomists these names lengthened out by the term *salpingo*, alluding to the σαλπιγξ, or tube of Eustachius, in which they partly originate, and in which they occasionally may produce some changes.

laterad, enlarge farther the isthmus faucium, and shut up the passage between the pharynx, the two Eustachian tubes, and the nostrils.

Thus the pendulous velum, which evidently performs the office of a valve, may, according to the muscles by which it is moved, enlarge, diminish, or shut up the passage leading from the pharynx towards the mouth, and likewise the passage leading from the pharynx to the two Eustachian tubes and the nostrils.

From its situation, it cannot however shut both passages at the same time; but must necessarily, unless when affected by disease, enlarge the one in proportion as it diminishes the other.

By the *petro-staphylini*, it narrows or shuts the passage into the nostrils and Eustachian tubes.

By the *staphylini* and *spheno-staphylini*, it widens and opens it.

By the *glosso-staphylini* and *spheno-staphylini*, it narrows or shuts the isthmus faucium, which, like the passage into the nostrils and Eustachian tubes, is opened again by the *staphylini* and *spheno-staphylini*; for these two pairs, by drawing the velum to a middle position between the passages that lead towards the mouth and the nostrils, lay open both communications at once.

The cavities of the nostrils into which the pharynx is seen to open, are not much subjected to the action of muscles; the only moveable parts which

they have, being the alæ and the cartilaginous part of the septum, which are varied only to a small degree. But though not subjected to much variety from muscular action, they often exhibit considerable differences as to form and extent in different individuals. They are sometimes found extending coronad in the *os frontis*, as far as the hairy scalp, laterad as far as the temporal extremities of the superciliary ridges, and iniad over the sockets of the eyeballs, as far as the fronto-sphenoidal suture; they frequently are found extending iniad in the *os sphenoides*, as far as the cuneiform process of the os occipitis, coronad and laterad in its temporal processes, where these give origin to the temporal muscles; they spread every where through all the cells of the *os ethmoides*, branch antiniad and coronad into the lacrymal sac, and thence into the four puncta lacrymalia opening on the eyelids; they extend laterally into the antres of the *coronal maxillary bone*, where, in some cases, these antres are so large, that the bone and its processes seem all to be excavated. The nostrils, in short, or those antres with which they communicate, are frequently found not only on the two lateral parts of the face, on the mesial, coronal, and basilar aspects of the two orbits, but in the basilar, the temporal, and glabellar aspects of the cranium itself. As the nature of sound is varied by diseases to which they are liable, we may likewise suppose that it is varied by their form and extent. In all

cases where disease is not present, these cavities contain air moistened by the vapour, and warmed by the natural temperature of the system. This air, mingling with the air inspired from the atmosphere, contributes to protect the olfactory nerves and pituatary membrane from the too great or too sudden changes with respect to heat, dryness, or cold, that might be induced by the air from without; and, therefore, when the parts are morbidly sensible, and this air not sufficient to defend them from external attacks, many individuals, when the cold is excessive, are instinctively led to draw the air through some porous substance that moderates its temperature before it reaches the mouth and the nostrils.

General Observations.

Considering that the air may be expelled from the substance of the lungs with a difference of force, velocity, density, and vibratory motion; that the trachea, through which it passes, may be lengthened and shortened, increased and diminished in its diameter, made more or less tense, and, by the quantity of its circulating fluids, more or less elastic: considering, too, that the ligaments of the glottis, which are naturally elastic, may also at the same time be lengthened or shortened, made more or less tense, and the aperture between narrowed, widened, or entirely closed: considering that all the cartilages

of the larynx are likewise elastic; that, in whole or in part they admit of changes in relative position; that the orifice of the larynx, between the epiglottis and the thyroid cartilage, may admit of some thousand changes of dimension; that the muscles of the pharynx, of the pendulous velum, the lips, the tongue, and the alæ of the nostrils, can produce millions of changes besides; and that all these changes may be produced with a difference of force, and a difference of extent, as instantaneouly as the will or thought, and with a degree of minuteness and accuracy beyond comprehension:—considering these things, it is hard to conceive how any person among the followers of Dodart or of Ferrein could, upon cool deliberate reflection, think of comparing this singular aparatus to either a wind or a stringed instrument of their own contrivance, or dispute for a moment, whether sound be produced by the vibrations of the two ligaments forming the glottis, or without vibrations, merely by the aperture that is formed between them. A slight change in the state of circulation, destroying the natural elasticity of these organs, is capable of rendering them completely mute, as not unfrequently happens in catarrh. For all sound, whether from a wind or a stringed instrument, must necessarily be the effect of vibrations, though these vibrations may be greatly varied by varying either the dimensions or actions of the different cavities, tubes, and apertures through which such vibra-

tions are conveyed to the ear*. The air itself, in these cases, must also be considered as a sonorous body, and as, when it strikes the Æolian harp, capable both of giving and receiving sonorous vibrations as it passes through the different organs of voice. In short, there is no general principle in either a wind or a stringed instrument, that is not to be found in these organs, while these organs have numbers of powers, that no instrument of human invention ever has possessed. Independent, therefore, of their different cavities, tubes, and apertures; independent of their glands, their nerves, their membranes, their ligaments, their arteries, their veins, and their absorbents; independent of all their numerous varieties, and their consequent modifications of action; considering merely the almost infinite number of motions performed by their muscles, varied in extent, force, velocity, in the mode of combination, and order of succession—we must surely be conscious that this system of organs can never be imitated, and far less equalled by art; and need not be surprised, considering the original compass of its powers, unfettered by habits, that it should be able, from varieties of stops, emphases, articulations, and cadences, to

* On the varieties of vocal organs in different animals, see *Vicq D'Azyr de l'Organe de la Voix*, and Cuvier's work on Comparative Anatomy.

furnish marked vocal distinctions, not only for kingdoms, nations, and languages, but for all the individuals of which they are composed; for all the individuals that are, that were, or that ever shall be; for all their sensations, passions, and diseases; and for every shade of which these are susceptible from age, sex, health, or disease.

CHAP. XVI.

MOTIONS OF RESPIRATION.

In the human body, the great reservoir of air is the lungs, in the two lateral cavities of the thorax. From our first inspiration, at the moment of birth, this reservoir contains always more or less of aerial fluid, and is never exhausted by any expiration that afterwards succeeds; not even by the last. The air within it is a mixture or compound, considerably different from that of the atmosphere; a compound which, by a mutual interchange between it and the system, and a mutual interchange

between it and the atmosphere, is constantly wasted and constantly renewed; and yet, with a few occasional varieties, is made to retain nearly the same general properties through all the ordinary occurrences of life. To accommodate the two species of interchange to all the varying functions of the system, a greater or less quantity of the compound is always detained in the reservoir; the inspirations and the expirations that follow alternately are more or less equalled in bulk, succeed one another in a quicker or slower order of succession, are performed with a greater or less force, and a greater or less degree of velocity.

The muscles employed in producing these changes, are those which dilate and contract the thorax.

The dilating muscles are the

Intercostales,
Supracostales,
Infracostales,
Diaphragma;
Assisted occasionally by the
Sternomastoidei,
Scaleni,
Serrati postici superiores,
Serrati antici,
Serrati magni *,
Subclavii,

* See p. 381. et Halleri Element. Physiologiæ, lib. viii. § 24.

Pectorales,
Latissimi dorsi,
Cervicales descendentes,
Accessorii ad sacrolumbales *.

The contracting muscles are the

Triangulares sterni,
Obliqui externi abdominis,
Obliqui interni abdominis,
Transversi abdominis,
Recti abdominis,
Pyramidales;

Assisted occasionally by the

Serrati postici inferiores,
Longissimi dorsi,
Sacrolumbales,
Quadrati lumborum,
Serrati magni;

and assisted always by the cartilages between the ribs and the sternum, by the manner in which the different ribs are articulated with the vertebræ, and by the ligaments intended to support the articulations; causes that, continuing to operate after death, depress the ribs, when the powers that acted by a vital energy are no longer able to oppose them.

As all the ribs are more or less curved, and as, from the middle part of their curvatures, they are all bent both towards the vertebræ and sternum, each will have a dorsal and sternal extremity; as all are flattened, each will have likewise two sides

* When the *sacrolumbales* are fixed atlantad, the *accessorii* must, by their contractions, draw the ribs to the point that is fixed.

and two margins: the sides of the first, beginning to number from the region of the atlas, are atlantal and sacral; their two margins, peripheral and central, the peripheral convex, the central concave; the former inclining somewhat sacrad, and the latter atlantad. But as we advance to the region of the sacrum, the sides become peripheral and central, the two margins atlantal and sacral; yet both the sides and margins respectively pointing somewhat to the different aspects to which the analogous sides and margins were observed to point in the first rib.

All the ribs are divided into pairs. Each pair has a different *curvature;* the curvature of the first pair is the greatest, and the curvature of the rest gradually less, to the twelfth pair inclusive.

Each pair has a different *inclination* to the axis of the trunk. The inclination of the first is the least; the inclination of the rest is greater, to the twelfth pair inclusive.

Each pair has a different *length*. The length of the first pair is the least; the length of the rest is gradually increased, to the seventh, or even to the eighth, inclusive, and thence gradually diminished, to the twelfth inclusive.

All are articulated with the bodies of the vertebræ, and all, excepting the two last, with transverse processes. Excepting also the first and two last, the individuals of each pair are generally articulated with two vertebræ, being each connected with the vertebral column opposite an inter-

vertebral space; where, situated near to the centres of motion on which the different vertebræ are moved, they are less exposed to any change of relative situation from inflections of the trunk.

From their strong connections with the vertebral column, their relative distances at that part can be very little increased or diminished, without either a rupture of the ligaments, a change in the vertebræ, or in the intervertebral cartilages.

All the pairs, at their sternal extremity, are pointed with cartilages, and in such a manner, that these cartilages, with respect to form, appear continuations of the ribs themselves.

The cartilages of the first pair are the shortest; the cartilages of the rest are gradually longer, to the seventh inclusive, and then gradually shorter, to the twelfth inclusive.

The cartilages of the first pair, to the seventh inclusive, are connected with the sternum; and the cartilages of the seventh, to the twelfth inclusive, connected with the diaphragm.

All the cartilages point somewhat atlantad; and of the cartilages articulated with the sternum, those of the first pair are always articulated at the greatest angle,—the angles formed by the other cartilages being gradully less, or more and more acute on the sacral aspect, to the seventh inclusive.

Measuring at the sternum, the distance between the first and second cartilages is always the greatest, and that distance gradually diminished to the seventh inclusive; the eighth pair of cartilages rests

upon the seventh, the ninth on the eighth, and the tenth on the ninth; the eleventh recedes a little from the tenth, and the twelfth recedes more from the eleventh.

All the pairs of the ribs are moveable, but those which are atlantad less moveable than those which are sacrad. Hence, during the contractions of the *intercostales*, which are calculated to diminish the costal interstices, all the ribs, in ordinary cases, may be seen to move a little atlantad. In this ascent, as the distances between them at their dorsal extremities cannot be diminished, their planes of inclination are changed.

In this change of the planes of inclination, the sternum and sternal extremities of the ribs are observed to move atlantad and sternad, and the cartilages of the ribs connected with the sternum to become less curved, and the angles which they form with the sternum sacrad to be somewhat augmented. The sternum, however, though it partly move along with the ribs, does, notwithstanding, from its connection with the *recti abdominis*, and some other muscles, make a considerable degree of resistance; a degree of resistance which is much increased upon the sternal extremities of the ribs by the elasticity of their own cartilages, and the moderating force of the *triangulares*.

By these resistances, the cartilages of the ribs connected with the sternum, force their ribs dorsad and laterad; and these forces resisted by the ver-

tebræ, the ribs are more bent near their dorsal extremity than at any other place. The cartilages, too, which, by entering the sternum at acute angles, more powerfully resist the ascent of their ribs, frequently bend the sternal extremities of their ribs sacrad, and more or less according to the degree of resistance which they had opposed.

From this resistance opposed to the ribs at their sternal extremity, and the action of the ligaments opposing their ascent at the dorsal extremity, the motion of the ribs is most conspicuous on the lateral aspects.

From the form of the thorax tapering atlantad, every rib, when drawn to the one immediately atlantad, is drawn not only atlantad and centrad, but rolled a little upon one or both of its extremities, and in such manner that its margin atlantad is turned a little centrad, and its margin sacrad a little peripherad.

From the resistance which is opposed at the sternum and vertebræ to the rotatory motion, and the motion atlantad, many of the ribs are found to be twisted; the twist greatest in the long ribs connected with the sternum, but greater or less in proportion to the extent of the motion near the middle of their curvatures, and to the resistance at their extremities dorsal and sternal.

As all the sternal extremities of the ribs, in their motion atlantad, must advance sternad; as all the ribs connected with the sternum are forced in their

ascent dorsad and laterad; and as all the ribs not connected with the sternum do, in ordinary cases, follow a little the motions of the rest,—the cavity of the thorax is by these motions not only enlarged, from the sternal to the dorsal, but from the sinistral to the dextral aspect.

In this enlargement by the *intercostales*, the diaphragm will oppose, with a moderating force, and in all directions, not excepting the atlantal, the motions produced in the seventh, the eighth, and the ninth pair of ribs, to the twelfth inclusive; although, upon the contraction of the diaphragm, if the ribs be more fixed than its *cordiform tendon*, and they generally are in ordinary cases—the cordiform tendon, drawn sacrad and peripherad upon every side, will be rendered less concave on its sacral aspect; the liver, the stomach, the spleen, and the intestines, all pushed before it in a direction towards the pelvis; its atlantal aspect rendered less convex; the mediastinum in the thorax elongated; the heart and pericardium both drawn sacrad; the lateral spaces between the diaphragm and costal *pleuræ* enlarged; and a third diameter of the cavity of the thorax, from the atlantal to the sacral aspect, considerably lengthened.

In proportion as this dilatation advances, the air within the lungs gradually expands, the pulmonic blood flows more copiously through all the ramifications of its artery; and, likewise, in proportion as the equilibrium between the external and inter-

nal air is in this way destroyed, the former is observed to rush into the lungs, and by its pressure, not only to assist the force of the blood, and the force of expansion in dilating the lungs, but in supporting the action of the diaphragm and the intercostals. And hence it is, that no person, with his utmost efforts, can dilate the thorax to any very considerable extent without the inspiration of air; although, even then, the muscles be assisted by the expansive power of the air already in the lungs, and partly by the blood, which, if we may judge from effects produced by injecting the pulmonic artery after death, will, if flowing with force, and in any large quantity, increase the size of the lungs as much as if we had inflated their vesicles with air.

When the thorax is dilated, the fibres of the *recti* and *obliqui abdominis* are considerably stretched, and their levers elongated *. With these advantages, beginning to contract, they draw the ribs sacrad and centrad, press the viscera against the diaphragm; while the diaphragm resisting, though with moderating force, the motion atlantad, pushes before it the heart and pericardium, shortens the length of the mediastinum, and, forced towards the ribs dextrad and sinistrad, diminishes the lateral cavities of the thorax. By these forces, by the contractile power of the lungs, and expansion of

* See page 355.

the air, from heat and vapour, the pressure of the atmosphere is overcome, and a volume of air, proportioned to the diminution of capacity in the thorax, expelled in expiration.

In this contraction, as the lungs are compressed upon every side, and regularly oppose, from the slowness of their action, a kind of resistance to the ribs and the diaphragm, if an opening be made into one of the sides, a portion of the lungs will frequently be seen to protrude through the orifice, or air to rush out, if air has been previously in the lateral cavity.—On the other hand, if, after a partial collapse of the lungs, the thorax be suddenly and forcibly dilated, by the removal of pressure from their surface, not only will the air within them expand, but the air from without be seen to rush in, both by the orifice and the trachea, until the equilibrium be fully restored :—or, if the circulation be continued unequally, and the blood happen to flow more quickly through the pulmonic than systemic ventricle, the accumulation of blood in the lungs will cause them to expand, in opposition to the pressure of the atmosphere thro' the lateral orifice. These phenomena have sometimes led physiologists to suppose, that the lungs possess a muscular power of expanding themselves, and that they expand exactly at the time when the thorax is contracting. But never have I seen the air flowing out by the trachea, while flowing in by the lateral orifice; nor out by the orifice, while it was flowing in by the trachea.

Though openings be made into both sides of a live animal, and the air be admitted till the lungs collapse, and even till the circulation has ceased; yet, if much vital energy remain, and the two openings be properly closed, all the air in the lateral cavities will soon disappear, respiration commence, and the circulation return as before, in a portion of time that seldom will exceed two or three minutes. This singular and sudden absorption of air from the lateral cavities, was observed by Hales and by Van Swieten; and I have again and again observed it in the numerous experiments of my late ingenious pupil Dr Sanders. In whatever state or form it is absorbed, we must suppose that it enters the absorbents opening upon the surface of the lungs; and if it there enter the absorbents, why may it not, in a similar state, after passing along the course of the trachea, enter the absorbents opening from the bronchi and pulmonary vesicles—a more natural passage, certainly, than that which has been contrived by some physiologists, who have somehow imagined that it maintains its intercourse with the blood by passing out and in, through pores in the sides of the veins and arteries*.

* But the change induced on the blood by respiration is probably owing more to exhalation than to absorption; for no artery exhales so freely as the pulmonic. A watery injection thrown into this artery with a small force, will flow copiously

Although an animal may continue to breathe for a short time with a small opening in each of its sides, yet as more air will generally enter by these orifices, during inspiration, than can be absorbed, or returned by expiration in the same time, the air that enters by the sides will accumulate, and soon stop respiration entirely.

From considering the different lengths of the ribs, their different curvatures, inclinations, and attachments, we might almost be led, *a priori*, to suppose that they would not be moved through equal spaces in the same time, either in dilating or contracting the thorax. In dilating that cavity, the *intercostales* and their auxiliaries are moderated differently in the different ribs, as may be seen from the different attachments of the muscles that oppose them. To give a few instances: In the fifth, the sixth, and seventh pair of ribs, they are moderated by the two *recti abdominis;* in the fifth pair to the twelfth inclusive, by the *obliqui externi abdominis;* in the seventh to the twelfth inclusive, by the diaphragm; and in the tenth to the twelfth inclu-

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into the bronchi, and without occasioning any thing like rupture in its smaller vessels; but whether the exhalation, or not, be the principal cause of change in the blood, pulmonic blood, when exposed to the air through the medium of its vessels, is always observed to change its colour a great deal faster while the exhalants continue to act with a vital energy, than when they act slowly and feebly as inanimate organs.

sive, by the *obliqui interni abdominis*. Much variety in the motions of the ribs must at times arise from this difference of muscular attachments; much variety, from irregular proportions of force, velocity, and extent of action; and much variety, from the numbers, combinations, and the forces of auxiliaries that are occasonally made to co-operate.

If some ribs be more moveable or fixed than the rest, and happen to be moved through different spaces in the same time, the same distances between them and the rest cannot be preserved. If a rib, for instance, move faster atlantad than the one immediately succeeding can follow, the distance between them will be increased; or, in moving sacrad, if it approach the rib that is sacrad faster than the rib that is sacrad retires, the distance between them will be diminished.

The numerous and accurate experiments of Haller have clearly shown, that in moving both atlantad and sacrad, different ribs move through different spaces in the same time; and consequently it follows, that in these motions some of the costal interstices were widened, some of them narrowed, and that some, where contiguous ribs moved together, preserved the same relative breadth.

On the general principle, that the *intercostales* attached to two contiguous ribs will, upon their contraction, whether the ribs be ascending or descending, draw the one that is most moveable to

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that which is fixed; it will follow, that when ribs towards the sacral extremity of the thorax are fixed by the diaphragm, by the *recti*, and other abdominal muscles, the *intercostales* will, upon their contraction, draw the moveable ribs to those which are fixed, and will make them descend.

In the usual dilatations, the costal interstices, towards the atlantal extremity of the thorax, are generally diminished; a few towards the sacral extremity enlarged; while some towards the middle are very little changed.

But though some interstices towards the sacral extremity be enlarged, all the ribs, notwithstanding, may ascend; and all accordingly often do ascend during the dilatation of the thorax: for, while the muscles whose interstices are enlarged, gradually lengthen, and act only with a moderating force against those which are atlantad, they may, and they often, continue to act with a greater force than those which are sacrad.

In the dead body, where the ribs often return to their planes of greatest inclination, the ribs atlantad being least moveable, the costal interstices between them are widened, while the costal interstices of the other ribs in the lateral aspects are considerably diminished, and the muscles that occupy them very much relaxed. Hence, in performing the operation of paracentesis on the dead body, as far down as the sixth or seventh rib, we are often obliged to elevate the ribs, as in inspira-

tion, to enlarge the interstice where the operation is to be performed.

In many cases, respiration is performed without any motion whatever of the ribs; the muscles that alternately contract and relax, being the abdominal muscles and diaphragm; the *intercostales* in these cases doing nothing more than preserving the ribs perfectly steady, and furnishing fixed points to the diaphragm, by which it may act on its cordiform tendon. In respiration, the motions of the ribs may therefore be either greater or less, or suspended entirely, according to circumstances.

In making experiments on live animals, even where the species of respiration is the same as our own, anatomists must often witness phenomena that can only be phenomena of rare occurrence. After considering that the actions of the diaphragm in ordinary cases, are different from its actions in sneezing and coughing, and these again different from its actions in laughing and hiccup; after considering that our breathing is varied by heat and cold, by pleasure and pain, by every strong mental emotion, by the different states of health and disease, by different attitudes and different exertions,—we can hardly suppose, that an animal under the influence of horror, placed in a forced and unnatural attitude, its viscera exposed to the stimulus of air, its blood flowing out, many of its muscles divided by the knife, and its nervous system driven to violent desultory action

from excruciating pain, would exhibit the phenomena of ordinary respiration. In that situation, its muscles must produce many effects, not only of violent but irregular action; and not only the muscles usually employed in performing the function, but also the muscles that occasionally are required to act as auxiliaries. If different anatomists, after seeing different species of animals, or different individuals of the same species, respiring under different experiments of torture, were each to conclude, that the phenomena produced in these cases were analogous to those of ordinary respiration, their difference of opinion, as to motions of ordinary respiration, would be immense; and some, from seeing the ribs that are sacral not ascending so fast as those which are atlantal, and consequently some of the interstices enlarged during inspiration, might hastily conclude, as Sabatier has done, though not with his usual degree of reflection, *that the intercostals are muscles of expiration* *.

The Intercostal Muscles.

In the interstices which they occupy, these muscles at certain places form two strata or layers, an

* Huitieme Memoire sur les Mouvemens des Cotés, et sur l'Action des Muscles Intercostaux.

external and internal, or peripheral and central; and in each row, from the rib which is atlantad being more fixed than that which is sacrad, their attachment to the former is considered as their origin; their attachment to the latter, as their insertion.

The fibres of the *peripheral layer* beginning at the vertebræ run sacrad and sternad; whence, measuring from the vertebræ, they necessarily act by a longer lever on the rib that is sacrad than on that which is atlantad*. This layer, in general, is observed to terminate not far from the junction of the ribs with their cartilages; for, had it been continued as far as the sternum, its fibres there would, measuring from the sternum, have necessarily acted, through the medium of the cartilages, by a longer lever on the rib which is atlantad than on that which is sacrad.

The fibres of the *central layer*, beginning at the sternum, run sacrad and dorsad; and thus, measuring from the sternum, necessarily act, through the medium of the cartilages, by a longer lever on the rib that is sacrad than on that which is atlantad*. This layer, in general, is observed to terminate near the angles of the ribs; for, had it been continued as far as the vertebræ, its fibres there would, measuring from the vertebræ, have

* See p. 281, 282.

begun to act by a longer lever on the rib which is atlantad than on that which is sacrad.

Where the two layers are found together between the cartilages and angles of the ribs, they necessarily decussate; but in that situation, not acting particularly on either of the two extremities of the ribs, they both act by a common lever in drawing the moveable rib to the fixed, and, in drawing it atlantad, produce a kind of rotatory motion, by which the atlantal margin of the rib is turned centrad, and the sacral peripherad. In this motion the rib moves, as it were, on an axis extending from its sternal to its dorsal extremity; and the levers of the fibres of both strata are here equal to straight lines drawn from the axis perpendicularly to the planes in which the fibres are situated respectively. From the conical shape, however, of the thorax, these lines, especially in the ribs connected with the sternum, will, at any given place between their sternal and dorsal extremity, be longer in the rib that is situated sacrad than in that which is atlantad: and hence it will follow, in this motion also, that the fibres composing the two strata will each act by a longer lever on the rib which is sacrad than on that which is atlantad; a lever which, during inspiration, will be lengthened, where the cartilages force their ribs dorsad and laterad, and increase their distance from the axis of motion, without being affected in its length by a change of obliquity in any of the fibres.

But notwithstanding that all these levers are strongly in favour of the motion atlantad, it must be recollected that the intercostals cannot elevate the ribs without the gradual expansion of the lungs; a gradual expansion that is not to be viewed as merely an effect, but rather as a cause of this elevation. From the intercostals acting with a force not able at once to resist their moderators, and to support a great deal more than a fourteenth part of the pressure of the atmosphere *, the addi-

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* "For though a man, by a peculiar action of his mouth and tongue, may suck *mercury* twenty-two inches, and some men twenty-seven or twenty-eight high, yet I have found by experience, that by the bare inspiring action of the *Diaphragm* and dilating thorax, I could scarcely raise the *mercury* two inches; at which time the Diaphragm must act with a force equal to the weight of a *cylinder* of *mercury*, whose base is commensurate to the area of the *Diaphragm*, and its height two inches; whereby the *Diaphragm* must at that time sustain a weight equal to many pounds. Neither are its counteracting muscles, those of the *Abdomen*, able to exert a greater force.

"For, notwithstanding a man, by strongly compressing a quantity of air included in his mouth, may raise a column of *mercury* in an inverted syphon to five or seven inches height, yet he cannot, with his utmost strainings, raise it above two inches by the contracting force of the muscles of the *Abdomen*. Whence we see that our loudest vociferations are made with a force of air no greater than this." Hales, *Statics*, vol. i. Exp. cxvi.

tional force to support that pressure must, during their contraction, be principally supplied by the air within the lungs. In proportion, therefore, as the thorax expands, the external air rushes into the lungs; and expanding the lungs in the form of a cone, the lungs are made to act like a wedge or inclined plane, and by their expansion to cause the ribs slide from their base towards their apex; or, in other words, to move them at the same time peripherad and atlantad. And hence it is, that merely by inflating the lungs with air in the dead body, we can elevate the ribs, as in inspiration, without the assistance of the intercostals.

Should any, however, accustomed to view the expansion of the lungs as rather the effect than the cause of the ribs moving atlantad, and so not be inclined to admit a fact that is contrary to their previous habits of thinking; to conciliate those habits, the fact may be expressed in a different manner, by saying, that the muscles, in dilating the thorax, induce the air to rush into the lungs, and derive much assistance from its pressure and expansion.

The Intercostals in two Layers.

The supposition that these muscles are in two layers, that the one might depress, and the other elevate the ribs in respiration, is a supposition that is now obsolete, and a supposition that appears to

have been formed by the very witchcraft of imagination, in defiance of all observation and experiment. A single layer, unless the course of its fibres had been changed at the sternal and dorsal parts of the interstices, must have produced opposite effects on the sternal and dorsal extremities of the ribs. A single layer could not so effectually have resisted herniæ as two layers, whose fibres decussate ; and with a single layer, the motions of the ribs sternad and dorsad could not have been performed with the same steadiness that they are by two; the central layer moderating the peripheral in the motion dorsad, and the peripheral moderating the central in the motion sternad.

The Fibres of the Intercostals run obliquely across their Interstices.

The peculiar actions assigned to these muscles are principally owing to their obliquity. By their obliquity, their length and their quantity of contractility are augmented ; by their obliquity, they are able to perform more extensive motions with proportionally fewer degrees of contraction, and, consequently, with less disturbance to their nerves, their veins, their arteries, and their absorbents* ; by their different obliquities, the fibres of

* See p. 279.

the two layers decussate, and more powerfully resist the protrusion of the viscera; by their different obliquities, they elevate the ribs at both their sternal and dorsal extremities; and by different obliquities, the two layers moderate one another in the motions of the ribs sternad and dorsad.

Abdominal Muscles.

There being few motions or attitudes of the trunk, or compressions of the abdominal viscera, in which these muscles are not concerned as moderators, motors, or directors, the state of respiration is not only varied with their different functions, but made to contribute to the steadiness and energy of their exertions: thus, in their strong and vigorous exertions to change or preserve the attitudes of the trunk, or compress the viscera, the ribs are previously somewhat raised, or drawn atlantad, and, as fixed points, made to resist the motion sacrad with more than usual degrees of steadiness; this steadiness, however, does not proceed, or proceeds but little, from the intercostals. These muscles, opposed in their functions by the great pressure of the atmosphere from without, and not having strength to elevate the ribs unless assisted by a like pressure of the atmosphere from within, the abdominal muscles, which are always favoured by the pressure from without, would, with no great exertion, depress the ribs, and expel the air,

while the intercostals could have no means and no power to prevent its egress. To account, therefore, for the more than usual stability of the ribs in cases of extraordinary exertion, we must have recourse to those muscles by which the egress of the air is prevented, or by which the quantity issuing from the lungs in a given time is accurately regulated. Now, these are the muscles of the os hyoides, of the cartilages of the larynx, of the velum pendulum, of the tongue, and of the lips. By these muscles the passages through the larynx, the isthmus faucium, the mouth, and the nostrils, may be widened, narrowed, or entirely shut; one passage shut, and another opened; or the whole of them shut, and the whole of them opened, as the will directs, and as circumstances require. It is hence that these muscles, by retaining the breath after full inspirations, or by regulating the quantity that issues from the lungs in a given time, cause the air in the lungs to afford that support or stability to the ribs, which enables the diaphragm and abdominal muscles to act with so much steadiness and energy in giving attitude and motion to the trunk, in compressing the viscera, in emptying the stomach, in expelling the fœtus, fæces, and urine. Nor are these the only general effects arising from the muscles that command the passages to and from the lungs: as mental emotions do not unfrequently extend their influence to respiration, the same muscles make res-

piration also, in its turn, to extend its influence to the mental emotions; and hence it is that we see persons under surgical operations, or in violent pain, holding hard their breath, and trying, as it were, to lessen their sufferings, or to confirm their resolution in supporting them: A fact too obvious to have escaped the admirable Shakespeare, who makes Henry say, in addressing his soldiers at the siege of Harfleur,

> Now set the teeth, and stretch the nostril wide,
> Hold hard the breath, and bend up every spirit
> To its full height.

As respiration is thus made to favour the motions and attitudes of the trunk, so these motions and attitudes are made in their turn to favour respiration. There are scarcely any who require to be informed of the happy effects of moderate exercise upon this function. And as for the attitudes; in phthisis often, and generally in asthma, and in hydro-thorax, where the diaphragm is forced to make great exertions in dilating the chest, the erect posture is adopted instinctively, and is sometimes indispensible, as in that posture only, the abdominal viscera, without any kind of muscular exertion, are disposed to move sacrad by their own weight.

To explain the phenomena observed by Hales*

* See note p. 532.

in trying to raise a column of mercury by the force of the air when inspired and expired, it is obvious, that air contained in the mouth, when it is inflated, may be driven to the lungs with a greater force than by the mere pressure of the atmosphere; as the pressure of the atmosphere, in this case, continues to operate on the muscles from without, and besides is assisted by whatever force the muscles exert in their contraction. In the same way, these muscles of the mouth may give an additional impulse to the air as it passes along in the time of expiration, or, by shutting the valvular apertures behind, may give a distinct impulse of their own.

Auxiliary Muscles of Respiration.

From repeated observations on the dead and living body, I enumerated these muscles, without any remembrance at the time of those that had been reckoned auxiliary by Haller. Our two enumerations, however, coincide, except in one instance, in which I have viewed the *serrati magni* as muscles occasionally employed in expiration *. The truth is, that the scapulæ being in their usual situation, some of the fasciculi of these muscles proceed atlantad, and some of them sacrad, to the

* See p. 381.

bases of the scapulæ; and that not a few of them, when the scapulæ are depressed, and the ribs in their planes of greatest inclination, seem obviously calculated to move their ribs sacrad: for although they appear to ascend from the sides, they ascend not so high as the dorsal articulations of their ribs, nor, consequently, so high as their axis of motion; and hence the scapulæ are always depressed in vigorous expirations, and these fasciculi made to assist the abdominal muscles. On the other hand, it must be acknowledged that the same fasciculi always oppose the abdominal muscles, by drawing their ribs dorsad and laterad*, and in drawing them sacrad, always act with a less and less force as the scapulæ are elevated, or as the inclinations of the ribs are changed, till at last, by the change, they come to draw them a little atlantad; and hence, partly, the cause why the two scapulæ are likewise elevated in very full and vigorous inspirations.

The effects of the two *serrati postici superiores*, as motors of the ribs, are increased by inflections of the neck sternad; the same inflections, with si-

* The cartilages of the ribs connected with the sternum, by forcing their ribs dorsad and laterad, promote the dilatation; and by forcing them sacrad during expiration, promote the contraction. The diaphragm also is made to co-operate with both the intercostal and abdominal muscles in enlarging and diminishing the capacity of the thorax.

milar inflections of some of the highest of the dorsal vertebræ, enable the *trapezii*, the *rhomboidei*, and the *levatores*, to increase their extent of action on the scapulæ, while the elevations of the two scapulæ assist not only the *serrati magni*, but the *subclavii*, the *serrati antici*, the *pectorales*, and *latissimi dorsi*, to elevate the ribs and support the intercostals; and hence we observe, that in phthisis pulmonalis, in dyspnæa and sneezing, the scapulæ are drawn atlantad and sternad, the shoulders rounded, and the head and neck placed in the positions that are most favourable to these muscles, so far as they contribute to enlarge the thorax. The simple knowledge of the origin and insertion of the other auxiliaries supersedes the necessity of any explanation of their mode of operating; although I may add, that the *sternomastoidei*, when the body has been lying horizontal and supine, have sometimes been unable to raise the head from the pillow underneath, from the want of a fixed point in the sternum, when the *recti abdominis* were incapable of resisting its motion atlantad*.

* "Graviori morbo decumbentem duo simul invisunt medici. Vultum, linguam, aliaque exploranda simul examinant. Inter hæc inopina quadam tensione musculorum abdominis aliquid hinc monstri ali indicat medicorum alter; alter nil quod timendum foret, expertus, timenti socio: Manum, inquit, admoveamus ambo simul, non quidem festinam, sed attentam. Dictum, factum. Ille musculorum tensiones non continuatas, sed

CHAP. XVII.

MOTIONS OF THE ALIMENTARY CANAL.

WHERE the food is not regularly in contact with the body, nor a sufficient quantity of nourishment conveyed into the system by the absorbents opening from without; or where the food necessary for the system is not fitted to enter the absorbents till it undergo some preparation, the animal is always provided with a stomach, if not with an alimentary canal; with organs of deglutition and digestion; with organs also of mastication, if the aliment be

laxitate identidem interpolatas miratur; magis autem miratur placidum atque imperterritum socii vultum, nullo hinc timore, nulla cura percitum. Scilicet hinc decumbenti occasionem subinde pepererat ea quæ circa pedes gerebantur, animadvertendi, utque eadem facilius animadverteret, caput eodem momento aliquantisper levandi. Novit anatomes gnarus, supino corpore jacentem caput attollere non posse, nisi trahentibus musculis mastoideis sterno mobili affixis, hos autem conari frustra, ni musculorum abdominis ope sternum simul reddatur immotum. Sat sapienti." HALLER, *Disputat. Anat. Select.* vol. vi. p. 759.

such as to require them; and with absorbents opening from within, to convey the nutritious part of the food, either directly, or through the medium of some other vessels, to the different organs.

In this canal the food is brought to the same temperature with that of the system; is always mixed with a variety of animal fluids from glandular ducts, or exhalant arteries; the nutritious part separated from the fæcal; and the fæcal afterwards discharged through the sphincter terminating the canal.

From the fluids exhaled into the canal being excrementitious, and from the exhalations being often more copious during the periods of sickness than of health, we are able to explain how the quantity of fæces may often be greater than the quantity of *ingesta*. From knowing likewise that disease may originate, or be greatly aggravated, by allowing the breath and perspirable matter of the sick to accumulate in the chamber around them, we are led to suspect that accumulations or absorptions of the fluids exhaled into the alimentary canal, must be fully as injurious as the inspiration of air that is tainted; and may thus explain the extensive utility and success of that practice which has been lately reduced to a system, and by which both the accumulation and absorption of these noxious exhalations are prevented *.

* See page 246.

In the human species, the alimentary canal commences at the lips, and terminates at the orifice which is called *anus* ; from the lips to the *isthmus faucium* it is named the *mouth* ; from the isthmus to the cricoid cartilage, the *pharynx* ; and from the cricoid cartilage to the diaphragm, the *œsophagus*. The œsophagus, as soon as it passes the diaphragm, dilates into a sac, which is called *stomach* ; the entrance to the stomach is the *cardia*, the passage out of it the *pylorus*. The pylorus opens into the *intestine*. Under this name the canal undergoes numerous convolutions; these convolutions are all, more or less, contained in the folds of *peritoneum*. The peritoneum is that membrane which lines the whole abdominal parietes on their central aspect. Between these parietes and the peritoneum, are situated all the abdominal viscera; and where these viscera are seen to project beyond the parietes, they have forced the peritoneum before them, and are lodged in its folds. On opening, therefore, the abdominal cavity, the peritoneum is interposed between the eye and every viscus that is named abdominal; and wherever it adheres is termed their *peritoneal coat*. Between this membrane and the dorsal *parietes*, are situated all the various convolutions of the intestine; and where these convolutions project at a distance from the parietes, the peritoneum completely surrounds them, the part of its fold between the convolution and the parietes being termed the *mesente-*

ry. This part of the fold which is termed mesentery, contains the nerves, the arteries, the veins, and the lacteals, more immediately connected with the convolution ; assists them in performing the office of a ligament to the intestine ; and performs, besides, as the peritoneum does every where else, the several functions of a mucous membrane.

In all cases where the viscera are in contact with the parietes, there is no mesentery ; nor at the place of actual contact is there any peritoneal coat.

In a young subject, the peritoneal coat is easily separated from the convolutions of the intestine. To do this, the anatomist has only to divide the intestine with the edge of his knife, to lay hold of one of the ends, and to draw it towards him : the intestine will come out of its peritoneal coat as out of a sheath ; and if the sheath be afterwards inflated, it will exhibit the general appearance and the convolutions of the intestine that was lodged in its folds.

The intestine is divided into different portions. From the pylorus to the commencement of the mesentery it is called *duodenum ;* from the commencement of the mesentery, and through all its convoluions, as far as the right iliac region, it is the *jejunum* and *ileum* ; which, if divided into five equal parts, the two first will be the *jejunum*, and the three last the *ileum*, although the distinction should not be retained. In the right iliac region

the intestine is suddenly increased in diameter, and likewise somewhat changed in its form. On the change of its diameter it is named *colon*; towards the commencement of the colon, where there is no mesentery, the ileum enters laterally its sinistral aspect, and in such a manner, that what it discharges into the colon cannot return; the part of the colon that is sacrad of the place where the ileum enters, is the *caput cæcum coli*, from which proceeds a small intestinal process, named the *appendicula vermiformis*. From the right iliac region the colon proceeds through the right lumbar to the right hypochondriac region; from the right hypochondriac, runs transversely to the left hypochondriac; and from the left hypochondriac, advances through the left lumbar to the left iliac region, where, turning a little towards the right, and running along the sternal aspect of the os sacrum, it terminates the alimentary canal. Where it occupies the regions on the right, it is the *right colon*; where the regions on the left, the *left colon*; where it runs transversely, the *transverse colon*; and where it runs straight along the os sacrum, it is named the *rectum*. At the liver it exhibits the *hepatic flexure*; at the spleen, the *splenic flexure*; and in the left lumbar and iliac regions, the *sigmoid flexure*. The portion of the peritoneum which fixes it in the right lumbar region, is the *ligamentum dextrum*; and that which fixes it in the left lumbar region, the *ligamentum sinistrum*.

From its commencement to its termination, the whole alimentary canal is surrounded with muscles; although, from the diaphragm to the anus, no muscular fasciculi are described separately, excepting the

Levatores ani,
Sphincteres ani,
Transversi perinæi;

the other carneous fibres being considered as only parts of what is denominated the muscular coat, and of which in the stomach there are evidently two strata.

The muscles of mastication are those enumerated under the motions of the basilar maxilla; those of deglutition are the muscles of the lips, of the tongue and os hyoides, the several muscles of the isthmus faucium, of the pharynx and œsophagus.

When the mouth is shut, and the tongue has forced the food through the isthmus, the several muscles constricting the pharynx act in succession, yielding before and contracting behind the object to be swallowed, till it reach the stomach.

In propelling the food through the region of the pharynx, the muscles are always greatly assisted by the pressure of the atmosphere acting through the nostrils; and hence it is, that when the mouth and the nostrils are shut, the deglutition is not only difficult, but sometimes impracticable. They are likewise assisted by the lubricating saliva,

which is mixed with the food; and hence it is, that the salivary glands, the parotid, the submaxillary, and the sublingual, are always found in those situations where they are regularly excited into action by the motions of the parts employed in mastication. In cases where no saliva is secreted, or secreted in too sparing a quantity, the solids that are dry require to be moistened artificially with water, or some other liquid; a practice that is never omitted by those who have what is termed a dry mouth,—a defect which in some families is hereditary.

In swallowing any thing liquid or solid, the tongue is observed to press against the palate; the larynx, by means of the thyrohyoidei, to start atlantad; the thyroid cartilage to press closely against the epiglottis, the epiglottis to press closely against the cartilage, and the larynx to shut till the food has passed into the œsophagus. If the quantity of food, however, be so small as not to excite the action of the muscles, or to arouse the feelings of instinct, the orifice of the larynx will in that case be imperfectly closed; and then often may a portion of the food get into the windpipe. Upon such an accident, it is not the muscles in the immediate vicinity of the injury that are thrown into action, but all the muscles, whether near or distant, that are calculated either to remove the cause or alleviate the effect.

When the food is in the stomach, its return is prevented partly by the diaphragm, whose fibres decussate, and form, as it were, a species of sphincter around the œsophagus, partly by a slight change of direction in the œsophagus, that advances sternad to pass through the diaphragm, and partly by a change of position in the stomach; a change of position that is always observed to arise from distension: For, in proportion as the stomach is distended, its atlantal aspect is inclined dorsad, its dorsal sacrad, its sacral sternad, its sternal atlantad; and in this way an angle being formed upon the œsophagus, an effect is produced, that completely answers the purposes of a valve. In cases of vomiting, the angle is removed by the abdominal muscles and diaphragm compelling the stomach to assume the position that it has when empty, or when nearly empty. As this pressure, however, of the diaphragm and abdominal muscles, must, *cæteris paribus*, always be less, as the distension of the stomach is diminished; although the position be more and more favourable, the extent of inspiration and of muscular contraction, in the efforts of vomiting, must always be greater in proportion as the stomach is emptied of its contents: And hence the practice of drinking water, and distending the stomach, in order to lessen the efforts of the muscles employed in vomiting.

As a sense of compresson is usually accompa-

nied with a sense of fulness; and as, from the want of ordinary compression, when the stomach is empty, we are naturally subjected to a sense of hunger,—many, to prevent this uneasy feeling, when they are necessarily exposed to fasting, have recourse to the use of a compress and bandage; and not only individuals, from casual suggestion, but whole tribes, from established custom, if we may credit the relations of travellers with respect to some of the Tartar hordes. By the action of the diaphragm and abdominal muscles, and successive contractions of the circular fibres belonging to the stomach, the food is propelled through the pylorus into the intestine; by successive contions of the circular fibres of the intestine, it is then propelled towards the rectum, while the fæcal part, accumulated in the rectum, and in the neighbouring portion of the colon, is afterwards forced through the sphincter ani by the abdominal muscles and diaphragm, assisted, if necessary, by full inspirations, and by the muscles that shut the mouth, the isthmus faucium, the nostrils, and the glottis.

The longitudinal muscular fibres of the intestine are not very obvious in the human species, nor indeed in many of the lower animals; and hence, in transverse incisions of the gut, the edges of the wound are but little retracted. The longitudinal bands of the colon evidently perform the office of

ligaments; and continuing to act in that capacity even after death, may easily be demonstrated to be the cause of the cells of the colon. At the same time, considering the great variety of forms, functions, colours, and irritabilities of different muscles, I can hardly presume to assert, that the fibres of these bands are not also muscular.

The motions produced by the circular fibres of the intestine have been named *peristaltic*, and have been compared to the motions of a worm; yet the motions of the worm and of the intestine are widely different: The worm is seen to inflect its body sternad, dorsad, dextrad, and sinistrad; to shorten it, lengthen it; to increase or diminish its general diameter; and to cause the motions of a number of parts to combine at a time in effecting these changes. But as for the intestine, it cannot be inflected sternad, dorsad, dextrad, sinistrad; and cannot be either lengthened or shortened by the contractions of its transverse fibres. Besides, the contractions of these fibres, proceeding from the stimulants within the intestine, and not being regulated by the general influence of the sensorium, are quite unconnected. On a cursory view, they indeed may appear to follow one another in a kind of succession, like wave upon wave; but they follow at no determinate distance in time or in space; and a portion of intestine intercepted between ligatures, exhibits its motions

independent of those which precede or which follow.

In morbid cases, where the order of nervous excitement is inverted, the contents of the intestine are sometimes thrown back upon the stomach, and discharged by the mouth.

The rate at which the contents are moved by the muscular contractions of the intestine, will necessarily be different in different individuals; and even in the same, at different times, much will depend on the force and velocity of the motor fibres acting behind, and on the resistance of the moderating fibres opposing them before. The action of the fibres, again, will depend on the state of their nerves; and the state of the nerves, upon the excitement induced by the contents. In all cases, a resistance will be made by the valvulæ conniventes; and this resistance will be greater or less in proportion to the fluidity of the contents, the fluidity being regulated by various circumstances, but principally by the state of exhalation and absorption that takes place in the canal. If natural evacuations were regularly to occur in twenty-four hours, the average rate of motion in the contents, through an intestine of twenty-four feet, would be a foot in the space of an hour, or an inch in five minutes; or if through an intestine of thirty-six feet, a foot and a half in the space of an hour, or nearly an inch every three

minutes. But as every portion of the intestine enjoys a separate independent power, and may act with a different force and velocity according to circumstances, these calculations, founded on hypothesis, are of little use in illustrating its functions.

As a constant discharge of the fæcal matter would necessarily be attended with much inconvenience, in all animals the intestine, towards its sacral extremity, is less irritable, and slower in its motions, than towards the atlantal; is in some animals considerably enlarged in its diameter; and in others is connected with reservoirs, under the name of *capita cæca*. By these contrivances, the matter being generally found to accumulate, or to continue stationary for a while, towards the sphincter, the animal enjoys a certain degree of discretionary power in choosing the time and place to discharge it; though, if the accumulations have been large, the evacuation is seldom complete; the animal system not being fitted to bear sudden and extensive changes without a proportional degree of injury. And hence we see persons often convulsed in emptying the bladder, and others faint, not merely from hæmorrhages, but from a sudden and copious discharge of dropsical water, to the pressure of which the system had for some time previously been accustomed.

From the discharge of the fæcal matter not being constant, the evacuation is not entrusted to the

mere peristaltic motions of the viscera. An instinctive warning is usually given by a particular uneasiness at the sphincter; and after the warning, a certain time is generally allowed for the necessary preparation. If in this time the will refuse to comply with the suggestion, the warning is repeated with more urgency; and should no warning have the effect, the instinct, as in cases where no law of morality opposes, imperiously takes the command of the muscles, and expels the fæces in defiance of volition. The muscles employed, or that may be employed, in the expulsion, are the circular fibres of the intestine, where the fæces are accumulated; and all the muscles that directly or indirectly, contribute to compress the abdominal viscera. Their moderators are the

Levatores ani,
Transversi perinæi,
Sphincteres ani,
Coccygei,
Curvatores coccygis;

which, after moderating the motor muscles, become motor muscles themselves; and acting successively in compressing the rectum, expel any remains of the fæces that may be lodged towards the extremity of the canal.

While the *transversi perinæi* and *sphincteres ani* are gradually contracting, they are drawn a little atlantad and sternad by the *levatores*, which are at

the time compressing the rectum; the integuments on each side of the anus, attached to the *sphincteres ani* through these muscles, moving a little mesiad and atlantad, the os coccyx advancing sternad by its own elasticity and the action of its muscles, and the bulb of the urethra dorsad and atlantad, from its connection not only with the *sphincteres*, but *transversi perinæi*.

The effects of respiration in assisting the muscles that are employed in the process of digestion, have not yet been mentioned, though certainly the pressure, and alternate motion occasioned by the diaphragm and abdominal muscles, cannot be without a considerable influence on the stomach, the liver, the spleen, the pancreas, and the intestine. They not only are varied, but regularly accommodated to every attitude which we assume, and to every exercise in which we are engaged; and in proportion as they are defective, it is generally observed that the processes of digestion are more or less accurately performed. Nay, if we may judge from the consequences of frictions, and from the effects of motion and pressure upon the parotid and submaxillary glands during mastication, we may fairly presume that respiration contributes not only to promote the circulation, but also the secretions, exhalations, and absorptions, that take place in all the abdominal viscera. Nor will it be an argument against the conclusion, that these functions are also continued when the

viscera are lodged in a hernial sac; for there is not a sac, and there cannot be a sac, communicating with the abdominal cavity, in which the viscera can be totally exempted from the effects produced by respiration; although in such cases they may acquire additional strength, and additional connections, by which they may always be somewhat accommodated to the change of circumstances. Yet with all these accommodating changes, and with every possible assistance from art, they never can perform their natural functions with the same expedition, safety, and force, and under as many varieties of circumstance, as they did when in their original situation, and when they were more completely subjected to the regular agitation and pressure arising from the diaphragm and abdominal muscles.

CHAP. XVIII.

MOTIONS IN THE EXPULSION AND RETENTION OF URINE.

THE muscles employed in performing these motions, are the

Abdominal muscles,
Diaphragm,
Constrictores vesicæ, seu detrusores urinæ,
Sphincter vesicæ.

In the male,

Compressores prostatæ,
Levatores ani,
Sphincter ani,
Sphincter ani alter,
Transversi perinæi,
Acceleratores urinæ.

After the urine is secreted in the kidneys, it is propelled by the successive muscular action of the ureters into the bladder; and the two ureters entering the bladder with an obliquity that is made to answer the purposes of valves, the urine accumulates as long as the *sphincter vesicæ* is shut. This accumulation, sooner or later, creates an uneasy sensation at the sphincter, and disposes that muscle to relax. To remove the sensation, as soon as an opportunity occurs, and the will consents, the *constrictores* are thrown into action, assisted by the pressure of the intestines, and occasionally by the diaphragm and abdominal muscles, till the whole of the urine is forced through the sphincter into the urethra. As the urethra has no sphincter to resist the current, the urine flows through its distal extremity with a force proportioned to the *vis a tergo*; and if, after the evacuation of the bladder, a few drops should remain in the urethra, the contractions of the sphincter and *compressores prostatæ* propel them onward towards the bulb;

from whence, by the successive contractions of the different fibres composing the two *acceleratores*, they are forced distad through the outward orifice.

In this function, the *acceleratores*, connected with the two *transversi perinæi*, and, through the *sphincter* or *sphincteres ani*, with the *levatores*, receive occasionally considerable assistance from these muscles; the two *transversi* compressing the urethra, by opposing one another in the directions dextrad and sinistrad, and by drawing it a little towards the rectum or *sphincteres ani* *; while the *levatores*, by drawing the *sphincter* or *sphincteres ani* atlantad and sternad, must indirectly lengthen the bulb, press it against the arch of the pubes, and stretch the fibres composing the two *acceleratores*. And hence, in evacuating the canal of the urethra, we are often conscious of the effects resulting from the two *levatores ani*.

REMARK.

If the *sphincter vesicæ* refuse to yield to the *constrictores* and abdominal muscles, the bladder is soon præternaturally distended: though during the distension the urine does not accumulate so fast as in ordinary cases: And hence it is, that after the

* From acting on the same point, they cannot possibly dilate the urethra dextrad and sinistrad, as is sometimes supposed.

accumulated urine is discharged by the catheter or trocar, the secretion in the kidneys becomes more copious, and a much greater quantity of urine flows into the bladder, and within a few hours from the operation, than had been collected during the whole time of the obstruction; a proof that the fluid from which the urine is formed in the kidneys, had during the obstruction been retained in the blood, and accumulated in the sanguiferous vessels, where it must have had a tendency to injure the other functions of the system.

CHAP. XIX.

MOTIONS OF THE MALE ORGANS OF GENERATION.

These organs are the *scrotum*, the *testes*, the *vasa deferentia*, the *vesiculæ seminales*, the *prostate gland*, and the two *corpora cavernosa penis*. Their muscles which are named and described by anatomists, are the

Darti scroti,
Cremasteres testium,
Compressores prostatæ,
Erectores penis.

As the cavities of the scrotum, in which the testes are contained respectively, are, like the integuments, frequently observed to contract in consequence of mental emotions, though not in consequence of any volition, and, like the integuments, observed to contract in consequence of cold, and, like the integuments, to be more lax during the later than during the earlier periods of life; many anatomists, from viewing these phenomena as analogous to those of the cellular membrane, and from finding nothing in the substance of the scrotum that does not resemble either integument or cellular membrane, have, not without some appearance of reason, denied the existence of such muscles as those which have been denominated *darti*.

The *cremasteres* assist not only in supporting the testes and spermatic cords, but, by their contractions, seem also to compress them; and, though not in consequence of any volition, are occasionally observed to retract the testes (if these retractions be not more owing to the vessels of the cords) as far as the rings of the *obliqui externi abdominis*.

The functions of the two *compressores prostatæ* are implied in their names. They sometimes appear as if they were portions or continuations of

the *levatores ani*, and sometimes have their appropriate origins in the bones of the pubes*.

The *erectores penis* are improperly named: They compress the crura, draw them dorsad and sacrad, and opposing one another in the lateral directions, prevent them from moving dextrad or sinistrad. They have very little influence in causing erection, excepting so far as they act upon the vessels. The erection is owing to the force of the fluids distending the cells of the corpora cavernosa, and may be produced by distending them with air, or any other fluid, in the dead body. In the living body, it generally proceeds from that inequality of the circulation, by which the blood is more accelerated in the arteries than the veins; an inequality that is often occasioned by mental emotions, though not by volition; by mental emotions affecting differently the arteries and the veins, which here, as in the eye, the brain, and some other parts, have a different course, are supplied by different branches of nerves, and exposed to considerable differences of action, from the organs which surround them. In the evening of life, when the sensibility is less acute, the mental emotions less energetic, the fluids scanty, and the circulating system comparatively feeble, there are few erections that do not proceed from either a disease of body or of mind, or from

* See Albini Historia Musculorum, lib. iii. cap. 98.

a distension of the urinary bladder, retarding the motion of the blood in the veins.

When the two corpora cavernosa are distended, the effects of the muscles named *erectores* become more conspicuous, partly in proportion as their action is extended, and partly in proportion as the two corpora cavernosa are elongated, and their distal extremity removed further from the centre of motion. In propelling the fluids forward to the cells, and also in drawing the corpora cavernosa dorsad and sacrad, the *erectores* either are, or may be assisted by the *levatores ani*, acting through the medium of the *sphincter ani* and bulb of the urethra, and partly also by the *transversi perinæi*. When drawn sacrad in a state of erection, they return to their place by their own elasticity, and by that of the ligament which connects them with the pubis.

When the seminal fluid enters the urethra, it is propelled by the same muscles that propelled the urine. As for its motion through the vasa deferentia, and the numerous ducts of which they are formed, supposing it propelled through their different convolutions by circular fibres acting in succession; yet if these fibres, as proportioned to the diameter of the tubes, be not more distinct and less pale than those of the intestines, the urinary bladder, and many of the arteries, it is hardly possible that they ever can be objects of ocular demonstration.

CHAP. XX.

MOTIONS OF THE FEMALE ORGANS OF GENERATION.

These organs are the *ovaria*, the *Fallopian tubes*, the *uterus*, the *clitoris*, and the *vagina*.

The Fallopian tubes are observed, in consequence of the sexual intercourse, to change their position to grasp the ovaria, and after the ova have burst thro' their covering to convey them to the uterus. But whether or not these functions be performed by muscular fibres, may with some remain a subject of doubt; for, supposing that muscular fibres were present, we could hardly expect them to be more obvious than those of the ureters or vasa deferentia; and therefore need not be much surprised if some physiologists, considering the time that the tubes take to perform their functions, considering the changes during that time in their sanguiferous and absorbent vessels, and their consequent changes in magnitude and form, should thence be inclined to

ascribe their motions to some other cause. I have only to observe, that things may exist without being seen; and that though the evidence of sense be strong, it is not the only species of evidence on which we are warranted to rest our conclusions.

The impregnated uterus continues to increase in its capacity till the time of parturition, though without a proportional diminution of thickness in its *parietes*; the thickness, in this case, being preserved by a gradual increase in the length and diameter of its veins, its arteries, and its absorbents, which here undergo still greater changes than they ever are observed to undergo from natural causes, in either the ovaria or tubes of Fallopius. The enlargement of the vessels seems to be owing to a temporary growth, and to an additional momentum of the blood; while their tendency to contract, and resist that enlargement, may probably, during the time of parturition, assist the diaphragm, the abdominal muscles, and the uterine fibres in expelling the fœtus. It is thus we explain how premature parturition is prevented by abstracting a part of the sanguiferous fluid, which during pregnancy, as during coition, has more than an usual determination to the sexual organs. Nor are these changes in the sexual organs in consequence of the blood so very singular as one might at first be inclined to imagine: Every change in the state of the organs connected with the vital energy of the system, is preceded or accompanied

by changes correspondent in the state of its vessels; and these changes in the state of the vessels will be greater or less proportioned to the extent and continuance of the action performed by the organs.

From the sudden, repeated, and evident contractions of the uterine fibres during parturition, we are naturally led to suppose that they are muscular. If they run not parallel, or radiate from a point, and form fasciculi, like the carneous fibres of most other muscles, they are certainly not more intricately interwoven than those forming the septum of the heart; if they be paler than the generality of muscular fibres, they are not paler than those of the bladder; if they gradually stretch for a number of months, and remain in a state of contraction as long, the only difference in this respect between them and the fibres of many of the sphincters is, that the periods of contraction and relaxation are more prolonged.

Previous to birth, the whole of the muscles, excepting those of the vascular systems, remain inactive. For a number of months posterior to birth, the voluntary muscles contract and relax either for longer or shorter periods as the will directs; the involuntary muscles, according to circumstances over which the will has no direct influence, or, if times be limited, according to periods which are assigned by the Author of Nature; and which periods we easily may suppose to be the periods

that are best suited to the nature of their structure, and to the general economy of the system.

The only muscles which have been named and described by anatomists, as peculiar to the female organs of generation, are the

Constrictor cunni, and
Erectores clitoridis.

The office of the first is implied in its name; and the office of the second similar to that of the *erectores penis*.

CHAP. XXI.

MOTIONS OF THE SANGUIFEROUS SYSTEM.

This system has two sets of veins, the one *pulmonic*, and the other *systemic*; two auricles belonging to the heart, the one *pulmonic*, and the other *systemic*; two ventricles forming the heart, the one *pulmonic*, and the other *systemic*; and two arteries issuing from the ventricles, the one *pulmonic*, and the other *systemic* *.

* See p. 231, 232.

The two sets of veins fill their auricles; at the same time the two auricles, by a synchronous contraction, fill their ventricles, when the two arteries, by a synchronous contraction, promote the circulation through all their branches, and into the extreme branches of veins. These events, in ordinary cases, follow one another in the way and order in which they are enumerated; the only deviations from the general rule arising either from a morbid structure or inordinate action.

When the auricles contract, the valves of the veins, the pressure on their sides, their conical form, the *vis a tergo*, and the momentum which the blood has acquired, conspire in resisting the retrograde motion; while the free passage into the ventricles, and the relaxation of their muscular fibres, contribute to favour the progressive motion.

When the ventricles contract, the case is different: the passages backwards into the auricles are comparatively large, the passages forward into the arteries comparatively small; the blood, besides, in passing to the arteries, is always resisted by a column of blood already in these vessels, and that resistance considerably increased by the conical form, and by the contractile power of the vessels, more apt to repel the blood to the heart, than to force it distad through their capillary branches. On these accounts, during the time that the ventricles are contracting, the passages between them and the auricles are shut by valves; these valves,

with the force of the blood pressing peripherad, making greater resistance to the lateral pressure produced by the ventricles, than the column of blood contained in the arteries.

When the blood is forced into the arteries, their curvatures, near where they issue from the ventricles, are from their distension lengthened and extended towards straight lines, and, causing the heart to participate in their motions, compel it to describe the segment of a circle, when the apex moving atlantad and sinistrad, is made to strike against the left side. The same kind of motion having also been observed by the celebrated Haller in distending the left or systemic auricle, it must follow, that the stroke which is given to the side may be the effect of two distinct causes, either acting separately or in combination, but acting on a heart, obliquely situated as ours is, in the cavity of the thorax, where the aspect of the base is atlantad and dextrad, and that of the apex sinistrad and sacrad. In combination, as the first of the two, by removing the pressure, will facilitate the influx of the venous blood into the left or systemic auricle, which is situated dorsad; so the second, by the influx of blood into the auricle, will contribute in its turn to facilitate the circular motion of the heart proceeding from the arteries.

To prevent any reflux arising from that degree of resistance which the arteries oppose to the blood in the ventricles, there are three valves placed at the commencement of each of the two arterial

trunks, and the only valves to be found in the whole arterial system.

From the arteries being full when the ventricles contract, the additional blood which they receive necessarily dilates them; and communicating an impulse, which is instantly felt through all their larger ramifications, propels, upon the recoil of the arteries, a proportional quantity through the distal extremities of the smaller branches *; though at these extremities, the concentrated force arising from the impulse is so much diffused, that the blood apparently flows in a regular uniform stream, the effects of the impulse being too minute for the notice of the eye, and seldom perceived, excepting in cases of morbid sensibility.

The Heart.

That the heart is capable, by its own exertions, of propelling the blood through the most distant branches of arteries, is probable from the cases where the arteries are ossified; and probable, too, from the small force that is usually required in the art of injection: for to inject the systemic branches from the aorta, requires not a force greater than that which the heart is often known to exert, though greater than that for which it has usually any occasion. In one of the experiments of the accurate and very ingenious Hales, the pres-

* See p. 227, 228.

sure of a column of warm water, four feet and a half perpendicular, was found sufficient, in the case of a dog, to impel the water from the aorta, and not only through all its capillary branches, but exhaling orifices. This learned writer, from his numerous experiments, was also of opinion, that three feet additional altitude would have forced the water in the same manner through the vessels of a man. From the comparatively greater facility with which an injection flows through the arteries immediately after death, before the vital warmth has escaped, or the blood coagulated; and from coarser injections, in these cases, returning sometimes even by the veins,—it must be obvious that many of the causes which usually prevent the success of injection did not exist in the living body. In the living body, the circulation already begun is only continued; all the arteries are already full, all the communications are open; the blood is flowing in its customary channels, in channels purposely adapted for its use, and for which it had been purposely adapted; nothing is omitted, nothing unforeseen, to promote circulation; nothing is wanting in point of fluidity; and nothing whatever is expected from the vessels that they had not performed a thousand times before. In these circumstances, the heart meets with only comparatively small resistance; and hence the impulse which it gives to the blood is instantly felt through all the larger ramifications

of the aorta. That this impulse is the principal cause of the motion of the blood, is not only probable from the previous facts narrated above, but probable also from what we observe in a number of insects, where the want of every thing resembling a heart, is accompanied also with the want of every thing resembling circulation; and probable too from what we regularly observe in the fœtus, where the circulation through the long and twisted umbilical cord is not performed by any particular structure of arteries, but by the combined force of the ventricles.

The Arteries.

Are we then to assert that the several arteries convey the blood merely as elastic inanimate tubes? Certainly not. We are neither prepared, nor are we willing, to make the assertion: For, though it may be granted that their different angles of ramification, their different convolutions, their different diameters, and their different modes of anatomising, can produce but effects that are merely mechanical in varying the force and velocity of the blood; yet many of the arteries have what we can demonstrate a fibrous structure; a structure observed to contract and relax with the slighter changes of mental emotion, implying that they act from a vital energy; while this vital energy, being differently exerted in different branches,

is also a proof that different arteries are endowed with different irritabilities.

All arteries are surrounded more or less with cellular substance; beneath this substance, in the larger arteries, is a dense membrane called *tunica nervosa*; beneath the tunica nervosa, again, are circular fibres, lying in a number of different strata of a dusty colour, and in that respect having little resemblance to either the tendinous or carneous fibres of the muscles which are known by distinct names; beneath these strata of circular fibres, is the innermost coat, in contact with the blood, and smooth and lubricated on its central aspect. In addition to these different coats, some parts of the trunks, where they issue from the heart, receive a covering from the pericardium; some a partial covering from the pleura, while they are in the thorax; and some likewise a partial covering from the peritoneum, while in the abdomen. Willis saw what he took to be glands in the coats of an artery belonging to an ox; and some have mentioned longitudinal fibres beneath the circular; but Albinus and Morgagni could see neither in a human artery. All have seen the vasa vasorum, the vessels intended for the nourishment of the coats. Many of the vasa probably terminate by exhaling orifices on the central aspect of their veins and arteries; and, by mixing their fluids with the currents within, may contribute to change the qualities of the blood by a

chemical process, as rapidly as either its force or velocity are changed by the muscles. It is thus we are in part able to explain those sudden changes in the qualities of the blood observed by Hewson, in consequence of a change in the mental emotions; and able to explain how some arteries are fitted to supply nourishment for bones, some for cartilages, some for muscles, some for tendons, some for ligaments, some for membranes, some for nerves, some for glands, and some for medulla and adipose matter; but fitted to supply them by such a combination of chemical, mechanical, and vital action, that we cannot presume to define the limits that belong to each. For in pursuing these minute arcana of nature, the most learned and the most ingenious physiologists are but too apt to remind us of the poet,

> Whom often Fancy, ludicrous and wild,
> Soothed with a waking dream of houses, towers,
> Trees, churches, and strange visages expressed
> In the red cinders, while with poring eye
> He gazed, himself creating what he saw.

With respect to the coats of the smaller arteries, whose structure eludes the most penetrating eye, some have imagined that they are analogous to those of the larger, and some have imagined that they are different. The late celebrated Mr John Hunter, finding by experiment that the trunks are more elastic than their branches, and being of opinion that elasticity and muscularity

are not only different, but belong to different classes of fibres, concludes, that the circular fibres of the trunks and the larger branches are wholly elastic. Notwithstanding this opinion, having shown by experiment, that all arteries are more elastic in the longitudinal than the transverse direction, he advances another, that the elastic fibres of arteries exert themselves chiefly in the longitudinal, and the muscular fibres in the transverse direction. Having somehow also satisfied himself that the elastic power of an artery was inversely as the muscular, he, in defiance of this inverse ratio, draws the singular inference, that they act as antagonists to one another; and that when the muscular fibres of an artery happen to contract it beyond the middle state, it is the elastic power that restores it. From supposing, too, that the effects of elasticity are immediate, while that of muscularity may be gradual, he has concluded, that the contractions of the umbilical vessels, which had continued for two days, were the effects of muscular fibres; and as he believed that muscular fibres could act only from a vital energy, he concludes again, that the muscles of the cord had continued to live for two days after their separation from the body. On the same principles, he might have concluded, that the ligamentum Nuchæ of quadrupeds is muscular, and that its fibres in some cases continue to live not only for two days, but a week, after all the vis-

cera of the cavities are extracted. With all deference to this ingenious and celebrated author, he has not established a clear, marked, and general distinction between what is elastic and what is muscular. Gradual contraction is no proof that a substance is either vital or muscular. Some substances contract from heat, some from cold, some from dryness, and some from moisture; nor is it any peculiar property of a muscular substance to be inelastic, as every living muscular fibre, either from the mixture of cellular membrane, or some other cause, is more or less elastic. The muscular fibres in the stomach of an ox are very elastic after being boiled; and the salted muscular fibres of ham continue elastic even for years. For these reasons, the elasticity of the circular fibres in the coats of an artery, is no proof that they are not muscular; nor is their muscularity any proof that they will not contract from other causes than a nervous energy, though a fibrous structure, with contraction arising from a nervous energy, be the characters that principally distinguish a muscle.

Wherever arteries, or any other animal substance, exhibit any thing like a fibrous structure; wherever nerves can be traced on these fibres; and wherever these fibres can be shown to contract, from the direct and immediate action of a vital energy,—I would have little hesitation in declaring these fibres to be muscular; and conse-

quently little hesitation in declaring, that the circular fibres, which are regularly seen in some of the larger arteries, are muscular: yet it will not follow, because some arteries have a muscular coat, that all arteries have a similar coat; nor will it follow, that others are destitute of a muscular coat, because a muscular coat is not seen, or because their coats will not contract in consequence of the stimulants which we employ. We have reason to believe there are many fibres in the animal body which are too minute or too transparent even for microscopic observation, and even demonstrative evidence, to believe that the nature of irritability is different not only in different species of organs, but in different parts of the same organs. Even the extensive contraction of a vessel, in consequence of stimulants applied to a part, is so far from demonstrating a muscular power, that it rather reminds us of the effects of irritability in certain plants. The parts of the intestine contract separately and independently of one another; and the only way in which we can stimulate them to act together, is to stimulate all at the same time, either by direct application to all, or by an indirect influence on all, exerted through the medium of a vital principle.

The Veins.

The veins exhibit no circular fibres, excepting a part of the larger trunks towards the auricles,

where, in certain experiments, and in certain animals, Haller observed that they had a pulsation. As this is the case, we can hardly expect to see circular fibres in the absorbents. Both veins and absorbents, however, are elastic as well as the arteries, and seem to contract from a vital energy; though, where there is no fibrous structure, or at least no fibrous structure that is seen, we cannot decidedly pronounce them to be muscular.

The contractile power of the vascular systems, how moderated.

This power seems to be moderated partly by the fluids, which, either from their momentum or quantity, are calculated to dilate the different vessels in which they are flowing. It is moderated, too, by one part resisting another, as in the intestine, where the contractile power that is before, is made to resist, through the medium of the contents, the contractile power of the part that is behind.

Auxiliary causes calculated to support or strengthen the action of the vascular systems.

Towards the surface, the vessels, and the parts on which they are ramified, are affected not only by temperature and moisture, but by mental emotions; and if temperature and moisture sometimes affect the mental emotions, the mental emotions affect in their turn the temperature and

moisture not only on the surface, but towards the central parts of the system: And hence it is, that animals have a power, to a certain extent, of generating heat, and of determining the circulating fluids to particular parts, in greater or less quantity and force as the feelings direct, or as circumstances require.

Gravitation and friction are well known to promote circulation, while the action of the muscles, and the several parts surrounding the vessels, may accelerate so much, by their lateral action, the motion of the fluids, that in many cases, as in violent exercise and phthisis pulmonalis, they throw the blood faster on the lungs than the lungs can discharge it by the most vigorous respiratory efforts.

The effects of respiration on the motions of the blood are evident and constant in all the genera of warm-blooded animals. Nor do I here allude to effects by which the blood undergoes a change in the pulmonary vessels, nor to the effects arising from temperature, by which the fluidity of the blood is preserved. I allude to effects which are purely mechanical; to those effects by which the lungs expand and collapse, by which the heart in the human body is regularly moved atlantad and sacrad, the mediastinum lengthened and shortened, the pericardium stretched and relaxed, and the blood in a part of the *cava inferior* accelerated or retarded by the actions of the diaphragm and abdominal muscles.

It is to these effects of respiration, and not to those imaginary muscles of the dura mater, that we owe the principal motions of the brain, which contribute so much to promote circulation in the cavity of the cranium. Haller has proved, that during expiration the blood accumulates, or is sometimes refluent, in the pulmonic auricle and veins, when the cerebral substance appears to expand, as it were, from the centre to the circumference; and that, on the contrary, during inspiration, when the blood has a freer passage through the lungs, the same substance appears to subside on the lateral, inial, and glabellar aspects, towards the centre. Similar motions have been frequently observed after the operation of trepan, and might have been inferred from accumulations of blood in the face, when the respiration is a little suspended. These phenomena partly explain why the blood, in returning from the cerebral substance, should pass through the sinuses of the dura mater*; why the peripheral aspect of the cerebrum, and the central aspect of the pia mater, should present to one onother two surfaces so widely extended. By numerous minute ramifications over these widely extended surfaces, the momentum of the blood, and the size of the vessels, are so much diminished, that injuries, arising ci-

* See p. 235. 236.

ther from increased momentum or quantity, are much resisted. At the same time, as the larger veins in which the accumulation takes place, are upon the peripheral aspect of the brain, or between the convolutions of its cortical substance, the immediate effects will be chiefly confined to the parts near the surface; while the expansion of these parts, resisted by the cranium and dura mater, will recoil upon the parts towards the centre, and in some measure contribute to compress them. The other motion which the brain seems to have, is what arises from the pulsation of its larger arteries; and which, like the veins, are ramified chiefly towards the circumference or peripheral aspect.

Along the crura of the spinal marrow, the circulation is farther promoted by the inflections of the vertebral column, but is apt to be languid in cases of debility, when sometimes the blood accumulates so much in the venous sinuses as to occasion painful sensations, particularly towards the region of the loins, where the inflections of the column had been greatest.

Midst the last expirations previous to death, when the passage through the lungs is gradually, and at last totally obstructed, the pulmonic blood accumulates not only in its auricle and veins, but in the pulmonic ventricle and artery. Whence this ventricle in the dead body has very often thinner parietes and a larger cavity than the systemic, the

several branches belonging to the artery being also larger in their diameter than the veins which accompany them*.

After death, the blood may sometimes continue to flow, independent of either the heart or the arteries. On opening the vessels of a dead body, we sometimes observe the blood rushing out, accompanied with expansive bubbles of air; and it is not improbable that bubbles of air, passing from the lungs into the aorta at the moment of death, or afterwards extricated by a chemical change, is one of the causes why some of the arteries are entirely empty, and others so nearly empty, after death. In these cases, as the blood cannot return to the heart on account of the valves, it is propelled by the particles of air towards the branches, when it either accumulates or enters the veins. That particles of air are ever extricated to promote the circulation in the living body, is what I would not presume to assert, though '. be not improbable, that the air which is extricated within the intestine, contributes not unfrequently to assist that tube in propelling its contents.

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* See Sabatier, *Premier Memoire sur l'Inegale Capacité du Cœur, et de Vaisseaux Pulmonaires.*

INDEX.

A

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FINIS.

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ERRATA.

Page 12. For "patabit," read "putabit."
21. For "internadii," read "internodii."
48. line 26. Dele "the."
49. For "spenoides," read "sphenoides."
169. For "sphenoidlea," read "sphenoidale."
205. For "tibiales postici," read "*tibiales postici.*"
225. line 25. For "regions," read "organs."
236. line 19. Dele "it."
314. For "that when they happen to vary their forces", read, "that when they vary the proportions of their forces."
321. Dele "*Directions.*"
330. For "173," read "178."
460. For "stapidis," read "stapedis"; for "stapidem," "stapedem;" and for "sinis", "sinus."
504, 505. in the notes. For "From", read "Form."

OMITTED,

190. "Anconei," as extensors of the ulna.
185. After the COSTÆ and their muscles, the **OSSA** STERNI and their muscles, viz. the

Recti abdominis,
Transversi abdominis,
Pectorales,
Intercostales interni,
Triangulares sterni,
Diaphragma,
Sterno-mastoidei,
Sterno hyoidei,
Sterno-thyroidei,

For their other attachments, see Index.
377. "Rhomboidei," as motors of the scapula, moving the base at. dor. mesiad.
415. "Sublimes," as flexors of the medial phalanx.
504. "Stylopharyngei," as constrictors of the pharynx.